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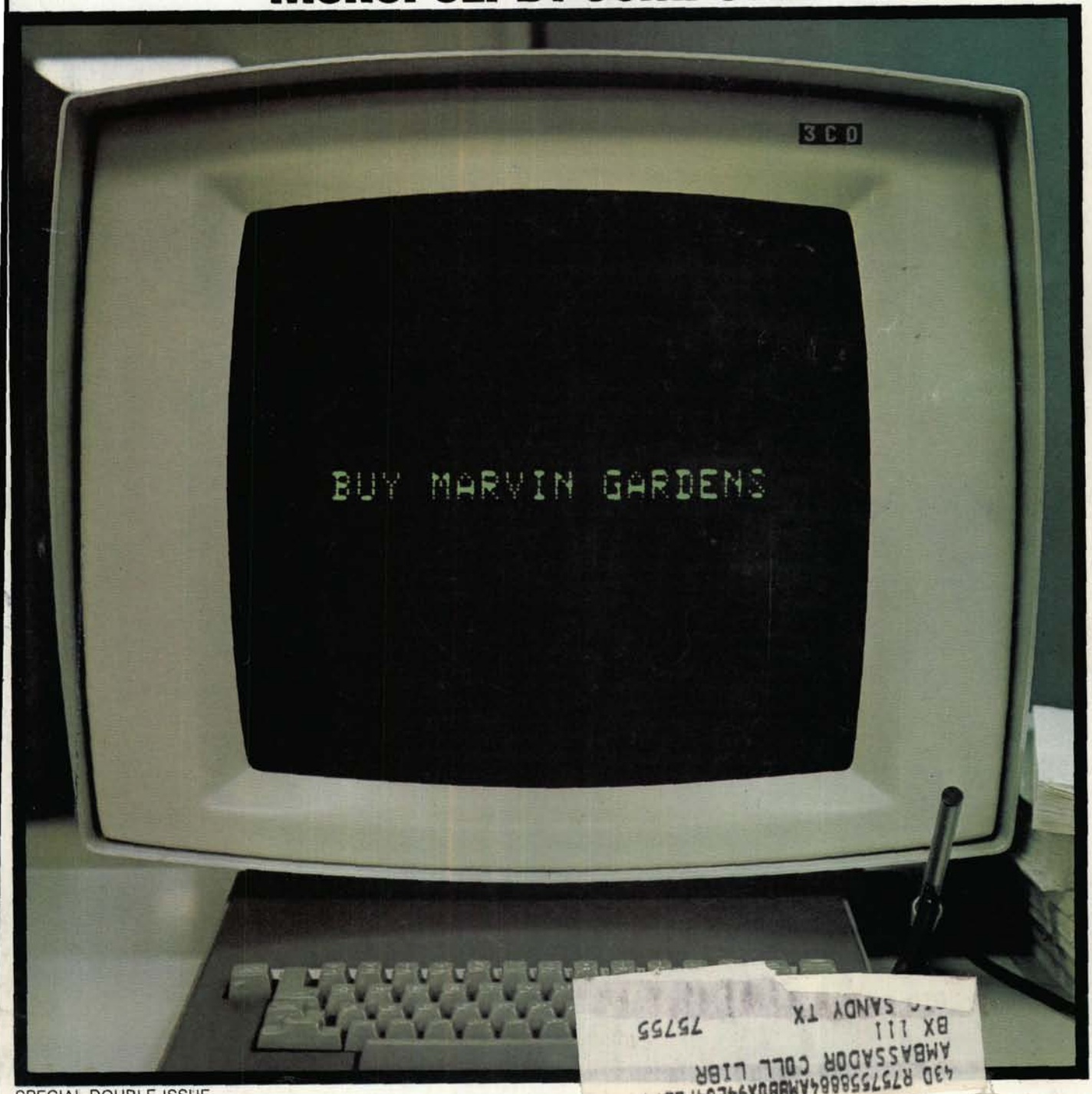

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Saturday Review of
THE SCIENCES

MARCH 24, 1973 VOLUME 1, NUMBER 3

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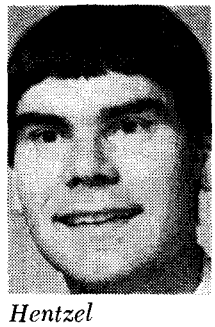
INSIDE SR

In a quandary over whether to buy Park Place or Illinois Avenue? Can't decide where to put your hotel? The man to consult is **Irvin R. Hentzel,** assistant professor of mathematics at Iowa State University and author of this month's cover story. Besides a Ph.D. in non-associative algebra, Hentzel's qualifications as a Monopoly master include a devotion to the game since age seven. From that point on Hentzel played almost every day after school, even when he had to patiently listen to his worthy opponent's accordian lesson before the day's match. Over the years he developed several hunches about the best way to play the game and the best properties to own. While utilizing the computer to construct non-associative algebras for his professional research, Hentzel discovered that he could also use the machine to pursue one of his favorite side interests—analyzing games. He spent two years devising a computer program to analyze Monopoly. A spokesman for Parker Brothers, manufacturers of Monopoly, expressed the belief that no one could devise a scientific strategy for winning the game. Still doubtful, Parker Brothers? Go directly to page 44.

Political scientist **Stephen P. Strickland,** author of "Choosing a Doctor," has long been fascinated by the intricacies of such fields as law and medicine. Over the past ten years he has held positions with federal agencies, Congress, and the White House, studying how policy is made. Especially concerned about health care, he is interested in the way people choose doctors; he believes that personal attitudes and actions will have as great an impact on the health of the nation as the decisions of policy makers. Strickland currently directs research and policy studies in Washington, D. C., for the University of California's Health Policy Center.



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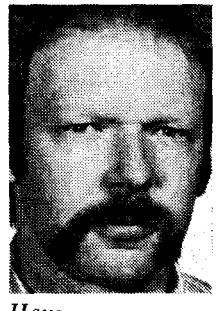
Strickland



Hays

Ernst

If winters appear to be getting colder and fuel or food shortages more frequent, the reason may be that we are moving into a new Ice Age. As **James D. Hays** explains in "The Ice Age Cometh," winter temperatures have been steadily declining since 1940. His current research focuses on the causes and past patterns of climatic change. He is chairman of the executive committee of CLIMAP (Climate Long-Range Investigation, Mapping and Prediction) and an associate professor of geology at Columbia University.

Eggspert **Ralph Ernst** was born and raised on a small poultry farm in Saline, Michigan. Now, with a B.S. in agricultural education, an M.S. in poultry management, and a Ph.D. in poultry physiology, Ernst knows that life on the farm just ain't what it used to be. In "The Egg and You" he describes the streamlined processes of egg production and the contributions of genetics, medicine, nutrition, and technology to advances in poultry farming. Ernst is a poultry specialist in the Agricultural Extension Service of the University of California.

In the special Travel Supplement in this issue of *The Sciences* we present a tour of some of the few unspoiled places remaining on the globe. **William Eschmeyer,** veteran of numerous expeditions to coral reefs around the world, points out what even the nonscientist can learn from these unique natural showcases. **Patricia Crowther** tells why a 29-year-old mother of two risked her life in the world's largest cave system. **Frederic V. Grunfeld** discusses a relatively undisturbed Mediterranean island, **Christine Hoover** takes us to the exotic Seychelles Islands in the Indian Ocean, and photographer **Steven C. Wilson** provides a tempting glimpse of the Olympic Peninsula, a spectacular rain forest in the American northwest.

F. K.

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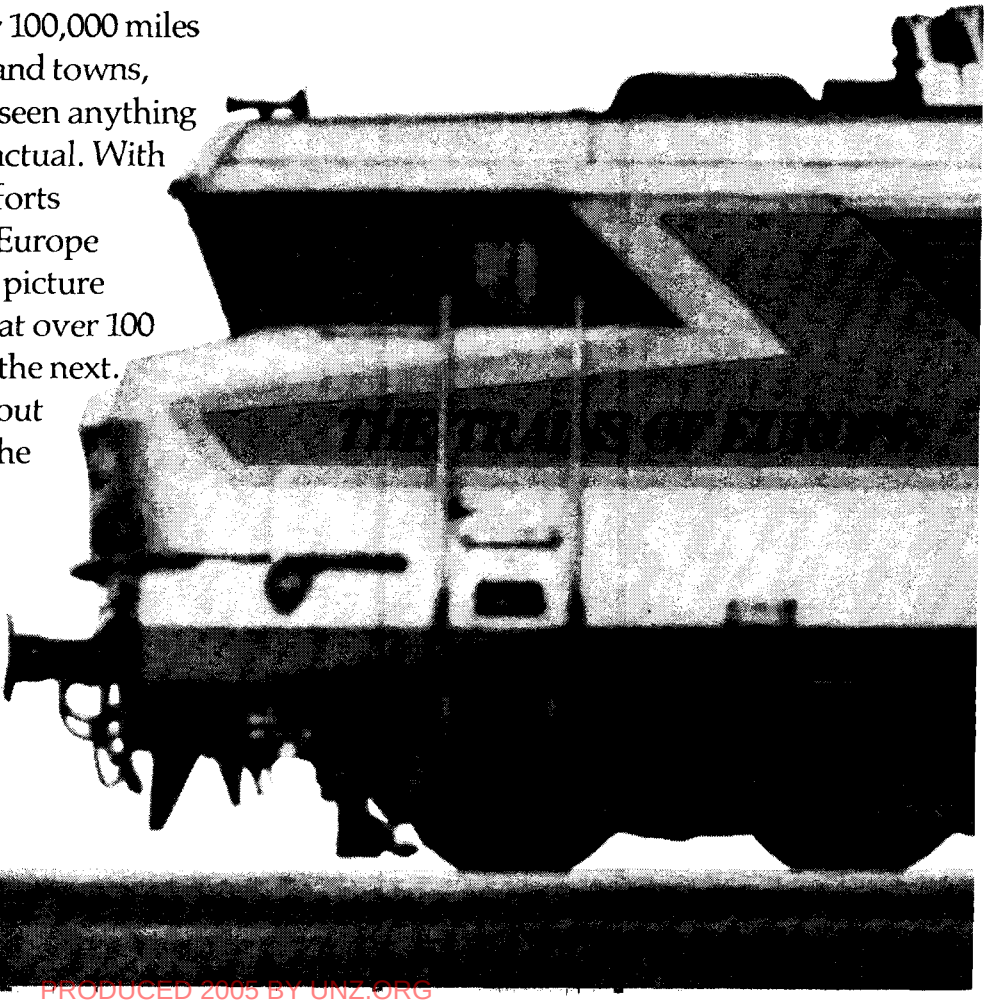

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THE ARTS

For too long, the arts have been iphered in a palace language, which / the initiated elite could understand enjoy.

Well, the editors of Saturday iew have created a monthly magazine oted solely to the arts, and to iphering the palace language.

SATURDAY REVIEW OF E ARTS features eight regular artments: Music, Cinema, Art, ater and Dance, Architecture and sign, Writing, Entertainments, People and Ideas.

It will keep you current, and olved. Some samples of articles:

¶The Perfect Rock Concert.

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¶The Great American Movie Game.

¶Claude Picasso on the private lections of America's best-known dern artists.

¶A look at mainland Chinese crafts.

¶Street mime in San Francisco.

¶The International Arrival of perimental sound.

You'll really enjoy SATURDAY VIEW OF THE ARTS.

EDUCATION

In today's Knowledge Society, problem is not getting new infor- tion: it is developing new ways to rn, and to apply new knowledge.

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There is more to educational ange than turning blackboards green.

Here are some of the things you will read about in SATURDAY REVIEW OF EDUCATION.

¶VD on TV.

¶Experimental Colleges.

¶Slow Learners.

¶Equality vs. Inequality.

¶Should schooling be compulsory? Direct reports from states where it is not.

¶Changes in mass "higher education."

¶Economic and social systems in the public school microsociety.

¶Are "educational" toys really educational?

¶Do "crash courses" for College Boards really help?

¶Education beyond college.

THE SOCIETY

The individual in today's society might as well be in a pinball machine.

Virtually everything that happens in society affects his life, yet for the most part, he is almost powerless to cope with it. The future shock phenomenon just accelerates the change, and makes its impact harder to take.

Well, the editors of Saturday Review have a partial solution to the problem. It's called SATURDAY REVIEW OF THE SOCIETY, and in a way, it is a survival manual. Its job is to keep you ahead of the current turmoil in society: politics, leisure, youth, labor unions, welfare, old age, advertising, environment, technology, the economy, communications, jobs, war, freedom.

Some samples of what it covers:

¶The Doomsday Syndrome.

¶Predicting Presidential Character.

¶The American Obsession With Fun.

¶A Tax Reform Symposium.

¶The Double Standard of Aging.

¶A Product Safety Computer.

¶The Swing Justice of the Supreme Court.

¶Can Wall Street Afford a Social Conscience?

¶The Skyjacker and How to Stop Him.

¶How the Army is Destroying Itself.

SATURDAY REVIEW OF THE SOCIETY will help you to understand the changes in society before they take place, and give you a leg up on dealing with them.

SCIENCE

Though science can be compellingly relevant in our daily lives, most of us never quite learned enough of it to put it to work for us.

Even the scientist is a layman outside of his field of specialization.

Yet up until now, there has been no magazine devoted to science that is fully comprehensible to the layman, enjoyable to read, and packed with useful knowledge.

SATURDAY REVIEW OF THE SCIENCES fills this void.

Here's a sampling of articles:

¶Death of the Elephants.

¶The Anatomy of Melancholy.

¶Isaac Asimov on the Ultimate Speed Limit.

¶The Life and Death of the American Chicken.

¶Senator John V. Tunney on Genetic Management.

¶Archeological Looting.

¶Zoos where people are caged while the animals run free.

¶The psychological implications of vasectomy.

¶The technology of TV violence.

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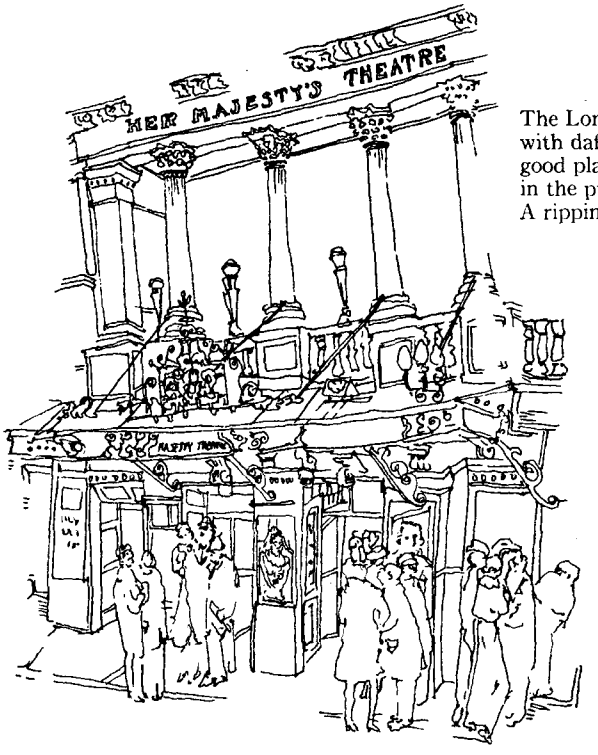
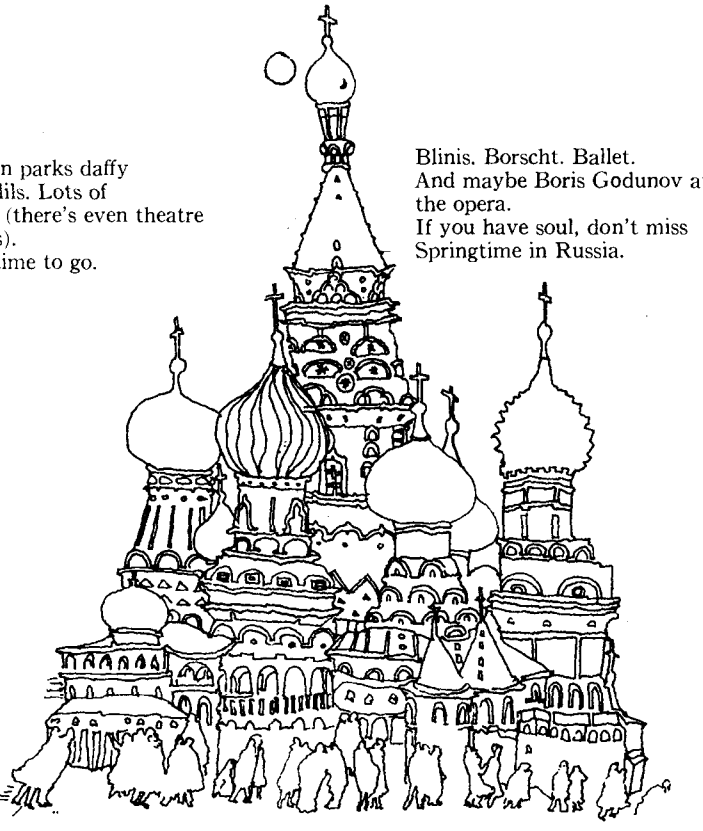


The London parks daffy with daffodils. Lots of good plays (there's even theatre in the pubs). A ripping time to go.



Blinis. Borscht. Ballet. And maybe Boris Godunov at the opera. If you have soul, don't miss Springtime in Russia.

8 days London with theatre, $290.
8 days London-Paris with theatre and nightlife, $310.
8 days Moscow-Leningrad, $475.

Every tour gives you lots of theatre tickets carefully picked accommodations, continental breakfast (all meals in Russia) with a batch of enjoyable extras. Through April only and the tours are best-sellers so be sure to act soon. See your travel agent. Tour prices are based on 7/8 day group economy fares from New York (we form the group) and are for each of two people sharing a twin-bedded room. Subject to government approval.

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Sailing a Plastic Sea

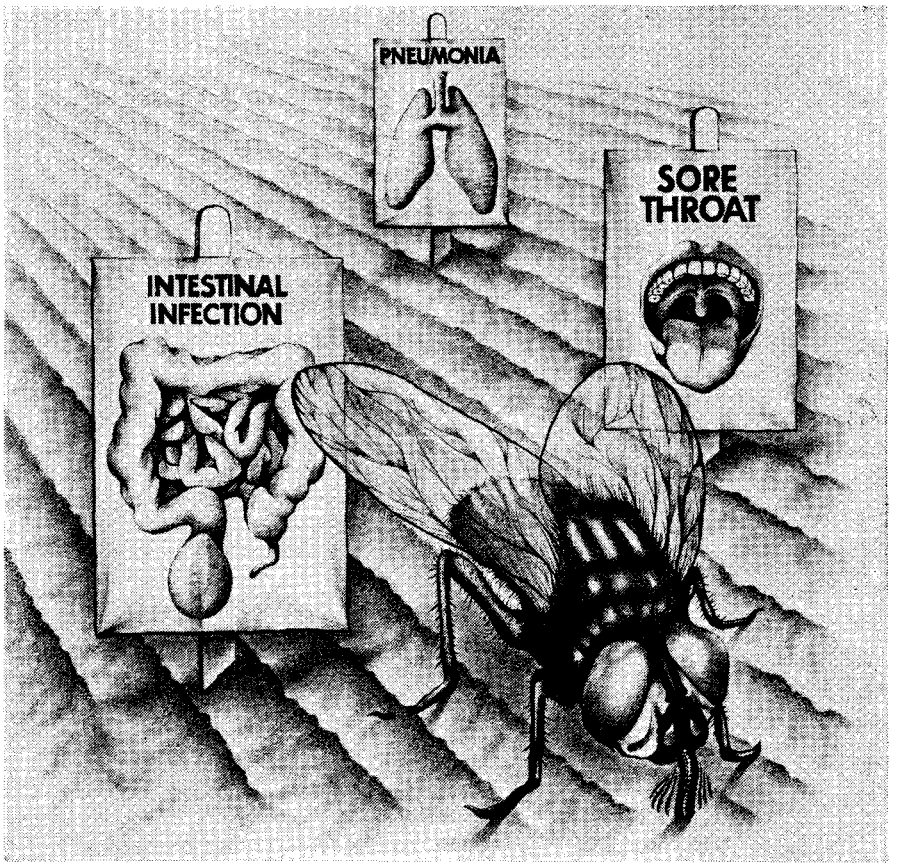
Everybody at some point or another gets bored during an ocean voyage, and scientists are no exception. However, the more imaginative ones seem to dream up unusual ways of putting those long hours to use.

Last summer, for example, a group of scientists from Scripps Institution of Oceanography found themselves in the North Pacific, some 600 miles from the nearest civilized port. In a little more than eight hours, they saw some 53 man-made objects float by their ship, more than half of which were plastic bottles. By calculating the distance at which they could identify flotsam and by working in the speed of the ship, the size of the oceans of the world, and various other mathematical parameters, they sat down and came up with the total number of plastic bottles adrift in the North Pacific: somewhere between 5 million and 35 million.

Now, that figure represents just plastic bottles. It doesn't include oil lumps, bits of rubber, light bulbs, or broken styrofoam. Writing in *Nature*, the scientists insist that "unless we find adequate means of disposing of our plastic products, we can anticipate that . . . our children will set sail into a plastic sea, accompanied by all the no-deposit, no-return products of our technology."

The "no-return" part may be too optimistic; Woods Hole biologists found last fall that some plastic—tiny polystyrene balls released as waste in southern New England—was endangering flounder, perch, and other ocean fishes that were eating it.

The recent bottle calculation somewhat parallels a similar exercise in which another group at Woods Hole figured out that most of the oil afloat on the oceans of the world was dumped there by operations of the world oil industry, not by natural undersea leaks, as that industry claimed. Of course, in the case of plastic bottles, there's no possibility of natural occurrence. Perhaps we can take meager solace in the fact that the more than five million bottles afloat represent only one-thousandth of the five billion or so made annually. □



Your Very Own Miniature Garden

BY SHEILA MORIBER KATZ

Our author tells of a research experiment that would work just as well with a bowl of potatoes:

In Philadelphia not long ago I trapped a common housefly in a sterile petri plate—the kind of glass dish that is routinely used for growing bacteria in medical laboratories. Lining the bottom of the dish was a standard culture medium, in this case blood agar, a reddish-brown transparent concoction of nutrients bacteria need to thrive. If there were germs anywhere on the fly, some undoubtedly would fall off as the fly walked over the agar. To give the bacteria the best chance to grow from microscopic groups to visible, pinhead-sized colonies, the petri dish with the captive fly was incubated at 37 degrees Centigrade. A control petri dish without a fly was exposed to the air and then also incubated. A day passed and the two dishes were withdrawn. There was nothing in the control dish to mar the smooth agar surface. Not so in the experimental dish. Along with the fly were eleven species of bacteria, all potentially capable of causing diseases, including sore throat (Group A beta hemolytic *Streptococcus*); pneumonia (*Dipoloccus pneumoniae, Klebsiella pneumoniae*); meningitis and conjunctivitis (*Hemophilus influenzae*); and bladder, skin, and intestinal infections (*Bacteroides, Pseudomonas aeruginosa, Mima polymorpha, Escherichia coli, Proteus mirabilis, Enterobacter aerogenes, Staphlococcus aureus,* and *Serratia marcenscens*).

Other inquisitive scientists might wish to use a fly to grow a similar bacteria garden. □

Sheila Moriber Katz is a pathologist at the hospital of the University of Pennsylvania Medical School in Philadelphia.

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Swan Song of the Eucalyptus

BY HENRY WEINSTEIN

When millionaire real estate promoter Frank C. Havens planted more than a million eucalyptus trees on the hills above the University of California's Berkeley campus during the early part of this century, he never dreamed he was creating the potential for a huge fire storm. But then, Mr. Havens, who touted the eucalyptus as "in many instances, the most valuable tree on the face of the globe," was wrong about a number of things.

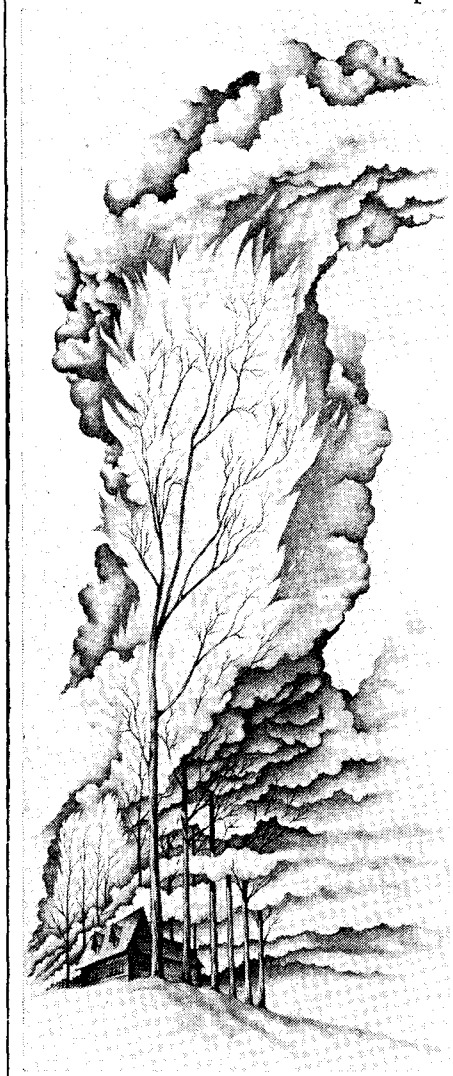
His Mahogany Eucalyptus and Land Company issued a prospectus claiming the outlook for lumber sale profits to be superior to "that of the average gold mine." The prospectus spoke glowingly of the get-rich-quick potential of eucalyptus, which could be used for pianos, violins, ballroom flooring, railroad ties, and ecclesiastical furniture within a decade after the Australian seedlings were planted.

Unfortunately, the three species of eucalyptus he chose—there are 180 in all—are less suited for timber than are any of the others. Bluegum, the predominant type that took root in California soil, is the worst of all. Its only use seems to be as firewood or pulp.

The problems with the eucalyptus, however, have become far more acute than its mere lack of commercial potential. Local park and fire officials and conservationists are trying to abate a severe fire hazard created by the death of thousands—perhaps millions—of Havens's trees as a result of a record-breaking nine-day freeze last December. They fear that unless action is taken soon, a holocaust may strike during the fire season early next fall, when the usual combination of high northeast winds blowing from the hills toward San Francisco Bay, hot September temperatures, and low humidity creates serious fire potential.

For the rationale behind this early caution, one only has to watch a single eucalyptus burn. The oily bark, hanging aloft in huge strips, provides rich kindling that turns the burning tree into a giant torch.

In Australia, where the eucalyptus is native, flammable ground fuel—sticks, branches, leaves, and partially decayed material—is kept down to 10,000 pounds per acre. Present measurements from the Berkeley hills "show as much as 100,000 pounds per acre," cautions Berkeley forestry professor Harold Biswell. Moreover, the highly flammable leaves on dead eucalyptus trees often don't fall for a long time, so that merely clearing ground debris won't solve the problem. The solution, says Biswell, is to chop down the trees. But since the typical eucalyptus is nearly two feet in diameter and about 125 feet tall, cutting is no mean feat. Nor is it inexpensive. For a private citizen to remove a dead tree near his home, the price would range from $150 to $300. So Biswell wants these hills declared a potential disaster area, qualifying them for state and possibly federal funds. The tree clearance could take months and cost several million dollars.



Currently the East Bay Regional Park District and several fire departments are conducting field surveys to determine how many dead trees there actually are. Elmer Silva, fire chief at the Lawrence Radiation Laboratory in Berkeley, reports that initial tests indicate about 90 per cent of the eucalyptus trees are dead, with about 1,000 dead per acre over an area of 3,000 acres. The characteristics of a dead eucalyptus tree are a brown interior layer and a sweet, fermenting smell, whereas a healthy tree has a white, smooth, slip-

Henry Weinstein is a freelance writer living in California.

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The Curious Legend of La Dame Blanche

Long, long ago, in the Bordeaux region of France, there lived a handsome young Count.

The estate on which he lived had a truly remarkable vineyard, from which came one of the finest wines in all of France. This wine was treasured throughout the land and was a source of great pride to the young aristocrat.

The people all loved him, for he was very good to them, and the fine wine he produced brought prosperity to them all.

However, they were concerned about one thing.

He had not yet found a wife.

One day, the Count decided to take a holiday, and he journeyed to Morocco. There he met a beautiful Moorish princess with dark mysterious eyes and black silken hair.

And skin the color of dark topaz.

She was, he thought, the most beautiful woman he had ever seen, and he fell hopelessly in love with her. And she with him. And so they were married.

When the news of the beloved Count's marriage to a dark-skinned woman reached the people, they were dismayed. And when he brought her home, they turned their backs on her. Why couldn't he have married one of his own kind?

Despite this, the pair lived happily together until the Count died. Then, his loving wife did something that shocked everyone.

She came to the funeral dressed in white... the color of mourning of her native land.

No one in France had ever worn anything but black for mourning. Oh, she had strange ways, this dark foreign woman.

The bereaved Countess wore nothing but white for the rest of her life, for she had loved her husband very much. So much so that, in his tradition, she continued caring for the vineyard. Which, in turn, continued to produce the superb wine.

She was really a very kind woman, and, like her husband, treated the people well. Slowly, they began to accept her. And they learned to love her as much as they had the Count.

Later, when she died, they all came to her funeral to honor her.

And they came dressed in white.

Now, here is the curious part of the story.

Ever since the death of the Countess, on certain mornings at dawn, a strange white mist drifts across the meadow and surrounds the Chateau.

And the people seeing this phenomenon, say, "La Dame Blanche has returned".

So when the white mist appears, the people are happy to be reminded that La Dame Blanche remembers them.

Today, the famous Cruse family occupies the Chateau. And their wine, now called Chateau La Dame Blanche, is still among the finest in all of France.

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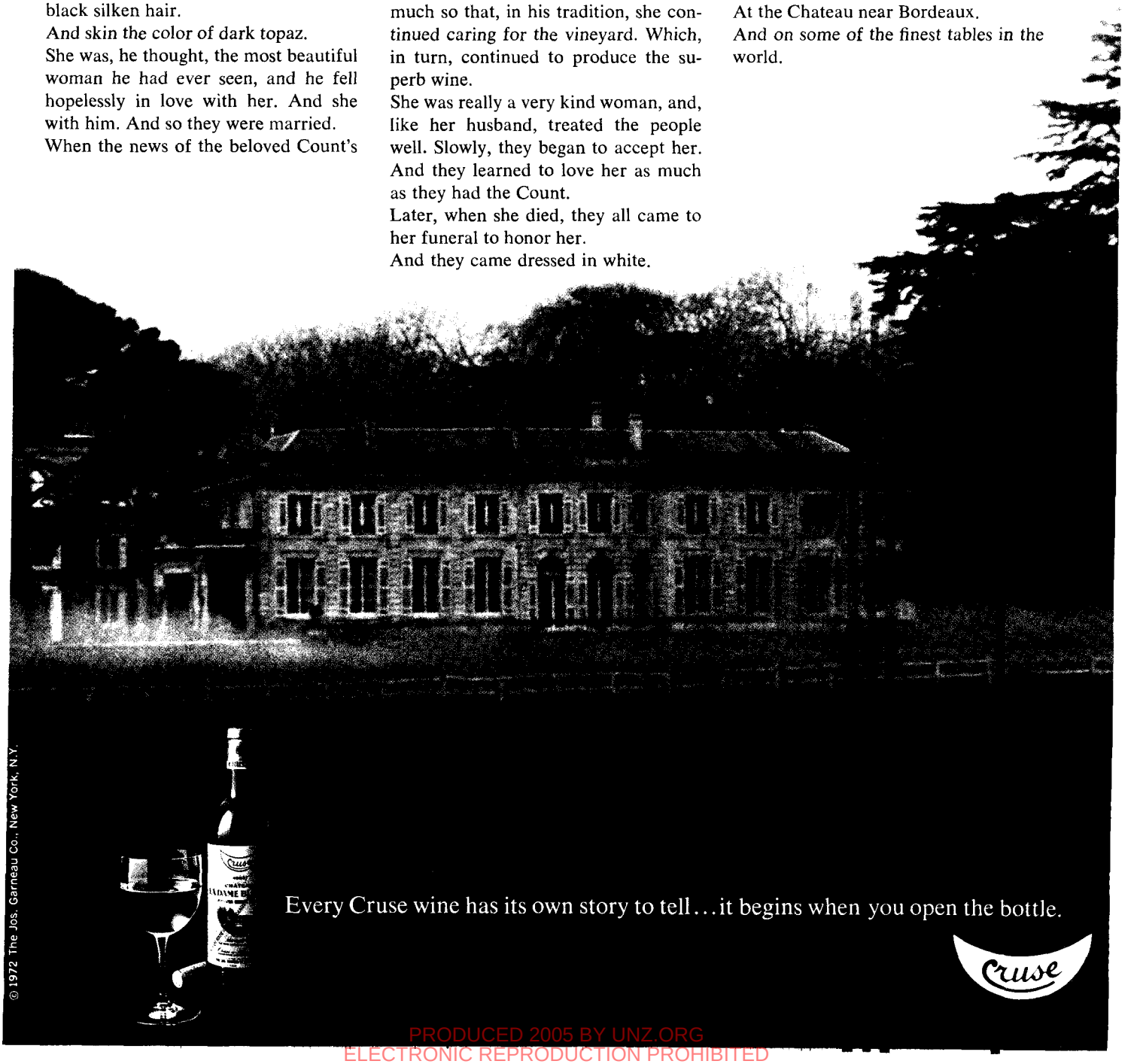

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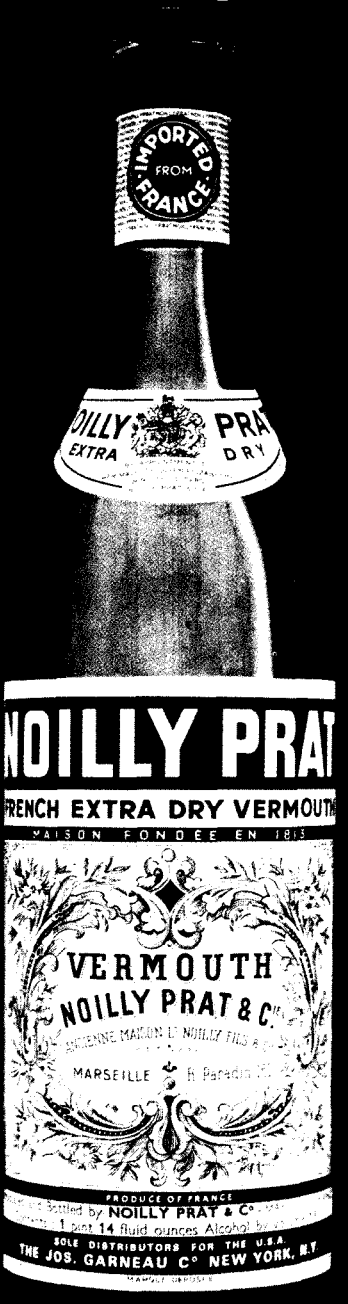
34 words on the Noilly Prat martini by W. Somerset Maugham.



"Noilly Prat is a necessary component of a dry martini. Without it you can make a side car, a gimlet, a white lady, or a gin and bitters, but you cannot make a dry martini."

"Points of View", 1958

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pery interior and a pungent, medicinal odor.

Along with cutting them down, the tree-clearing teams probably will use the technique of controlled burning ["Smokey's Mid-Career Crisis," *SR of The Sciences*, March 1973], which has the advantage of duplicating a natural process and costs only a tenth as much as chain-saw timbering.

It is perhaps surprising that there may not be much controversy over this tree-clearing operation, although David Gancher of Friends of the Earth expressed concern over "destroying the nesting place of hawks if you cut down a lot of trees." Nonetheless, the eucalyptus-clearing operation probably will be beneficial to the wildlife. A stand of eucalyptus trees inhibits the growth of other plants, thereby eliminating much in the way of herbivorous wildlife.

Indeed, this winter's frost proved that the eucalyptus is not totally suited to the Northern California climate. This might be a good opportunity, says Sierra Club forester Gordon Robinson, to return to the redwood trees that, before they were whittled down for lumber, served as a landmark for sailors entering San Francisco Bay. □

Interdisciplinary Obfuscation

Peter A. Morrison of the Rand Corporation in Santa Monica, California, began a speech not long ago by describing how specialists in different fields can work together and arrive at total obfuscation. Called the interdisciplinary approach, this is the way it works:

"In our population studies, for example, we draw on the perspectives of economists, geographers, and sociologists.

"Economists know the price of everything but the value of nothing. An economist, it is said, would marry Elizabeth Taylor for her money.

"The geographer, of course, believes that everything is connected to everything else, only more so, the nearer things are to each other.

"And a sociologist is someone who can spend a hundred thousand dollars of somebody else's money to discover that a house of ill-repute is located just around the corner. He reports this finding in a language that no one can understand.

"The hallmarks of an interdisciplinary study, then, are that it seems overpriced, it shows that everything depends on everything else, nobody really understands what it says, and the money [it costs] turns out to have been yours." □

Contented Cows

For years Japanese livestock raisers have been keeping cattle in tiny pens, providing them with a steady diet of beer, pleasant surroundings, and other amenities to produce the famous Kobe beef. If pampering the cows produces better beef—and more of it—why shouldn't the same technique work for milk? To find out, American dairymen are moving their herds out of the pasture and into carpeted stalls with piped-in music—preferably classical.

According to the Dairymen's League Co-op, the contented cows actually do produce more milk. It is a moot point whether they actually prefer being moved indoors—where they also get daily baths—or whether the motivation to produce more milk lies somewhere else, interspecies communication being what it is.

Nonetheless, increasing numbers of dairy farmers are remodeling their barns. Because cows are impossible to housebreak, the present trend is toward tough indoor-outdoor carpeting—it's easier to clean and tends to stand up better under the hooves of a herd. Another new wrinkle is computer mating: the farmers keep records of high-yield offspring and use a computer to calculate the best matrimonial matches. Indoor quarters, mating by computer, an atmosphere of soft rugs and piped-in music? If the trend continues, the cattle will wind up living on Fifth Avenue, and the rest of us may be happy to settle for a barn. □

Animal Quiz

BY LARRY HOTHEM

OK, animal fans, just to be sure you are really reading the magazine and not just looking at the pictures, here is a quick test of your zoological vocabulary. If you do well, you have some soundly based assurance that you . . . well, that you did well.

Consider: many names of animals contain within them the names of other animals. In the following rhymes the first line describes an animal, the second line an animal with a shorter name contained within the first.

Example:

Croaking loudly all the night;
Pawing earth and giving fright.
(8 letters) Answer: *Bull*frog

Now try the rest:

Ugly now, it will fly in the blue;
Heard late at night, you'd grab a shoe. (11 letters)

Larry Hothem's articles have appeared in more than 50 magazines.

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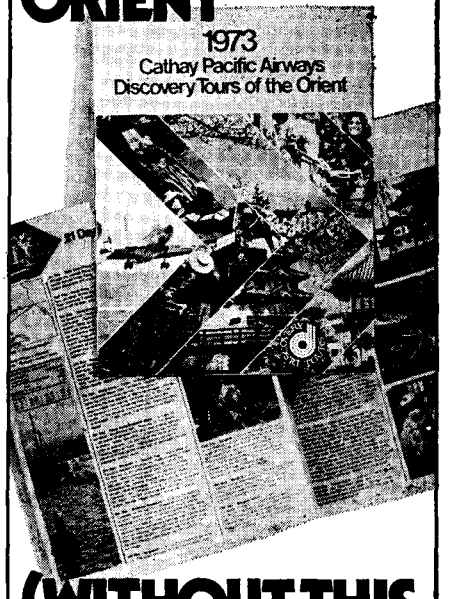

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Bushy-tailed, with a bright, pointed face;
A very large body, a very slow pace. (3 letters)
One of the largest and the tall;
One of the smallest of them all. (8 letters)
It stings from the tail to make you bend;
And this one strikes from the other end. (4 letters)
One of the apes, with a face multi-hue;
A 50/50 chance that this is you. (8 letters)
A western sheepman must take care;
If you catch fish, you might get a scare. (6 letters)
The dry "buzz" will give you a fright;
He and his friends prowl at night. (11 letters)
Hunt him with the nobles, if you please;
Watch so this one doesn't squeeze. (4 letters)
These make statues most surreal;
They use all this except the squeal. (6 letters)
It tunnels the ground and has a hard shell;
Safe at home, with sweets to sell. (6 letters)
Here the shroud means life again;
The ring-tail washes all food clean. (6 letters)
Great, sharp teeth, an armored tail;
Spoons of this oil once made you wail. (9 letters)

Answers: *Caterpillar, Fox, Elephant, Wasp, Mandrill, Cougar, Rattlesnake, Boar, Pigeon, Beetle, Cocoon, Crocodile.*

Half right is above average. Six to nine correct means that you know your birds and bees. Ten to twelve correct indicates that you're familiar with both the wild kingdom and your dictionary. □

Salt of the Earth

Those who distrust the idea of salting the roads in winter—who've been stuck behind a spreader spewing salt pellets at the paint job and windshield and through the winter watched their rocker panels and resale value slowly dissolve—can now add the force of environmental arguments to their personal disgruntlement.

The problem is that the salt—nine million tons a year—doesn't stay on the roads. Along with the slush and ice it melts, it is carried into the watershed—and from there into our streams, lakes, and reservoirs. According to the Washington, D.C., citizen's group Environmental Action, there are 63 communities in Massachusetts alone that are on medical alert because the sodium (road

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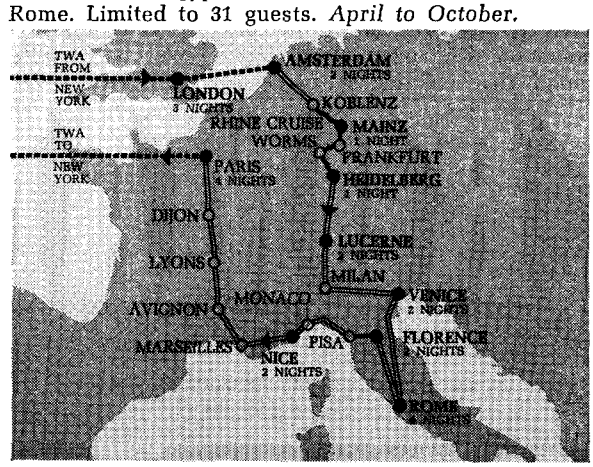

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salt is either sodium or calcium chloride) content of the drinking water has gone above 20 parts per million (ppm), the maximum safe level for heart patients who must restrict their salt intake.

Vegetation also is being affected. Research collected by Environmental Action shows that 500 pounds per tree annually is enough to kill a healthy maple, and the citizen's group says many trees are being exposed to such levels of salt pollution.

Even healthy people may be affected by the increasing levels of salt in drinking water. According to the U.S. Public Health Department, water with a salt level exceeding 250 ppm is unfit for domestic consumption, and the desirable level is actually fewer than 25 ppm. In the Illinois River at Peoria, chloride concentrations have gone from 25 to 95 ppm as a result of road salting. However, the record for salt pollution is probably held by the Meadow Brook, in Syracuse, New York, where an astounding salt measurement of 10,650 ppm was recorded in December 1969.

Aside from the direct effects of salt, scientists are discovering that the side effects may be even more corrosive to our health. In some areas the salt greatly increases the problem of mercury contamination. One team of scientists has found that chloride ions release mercury compounds that have been trapped in the bottom sediment of lakes and streams, raising levels of mercury in the water to anywhere from 100 to 100,000 times the normal level.

For those whose main concern is their cars, the Society of Automotive Engineers confirms that automobiles in the snow belt suffer corrosion damage of about $100 per car per year. The collective automotive loss may be as high as $3 billion per year.

Nor have the supposed safety benefits of road salting been unequivocally established. One study in Michigan showed that although accidents under icy conditions decreased with increased salt use, the *total* number of winter accidents increased, perhaps because of reduced visibility from salt splatter or a false sense of security induced by salted roads.

In response to reports such as these, at least one community, Burlington, Massachusetts, has entirely banned salt from the streets—with no increase in accidents and no fatalities, thanks to an intense driver-education program. And in 1971 the state of Minnesota passed a law drastically restricting the use of salt for snow removal, except in unusual circumstances.

It is unlikely that salting the roads will be stopped immediately; Americans have been taught to expect summertime road conditions in midwinter. But as the environmental and economic costs of salting become apparent, we may see a revival of the old-fashioned plowing and sanding. □

Flat-Footed Flies

Flies lay their eggs on the underside of mushrooms, a rather precarious perch, considering the slippery gills of these fungal hatcheries. For a better foothold, some flies are flat-footed, which gives them an almost sucker-like purchase on the mushroom, according to University of San Francisco entomologist Dr. Edward Kessel. How does anyone find out what goes on under mushrooms? You dig a hole big enough to accommodate your head, and you get down there and look up at the mushroom, says Kessel. That may explain why there aren't many entomologists studying flat-footed flies.

Wilder's Brains

Shortly after he was hanged in Binghamton, New York, on May 18, 1871, convicted murderer Edward Howard Ruloff underwent what can only be described as an uncommon operation. His brain was carefully removed from his skull, thoroughly embalmed, gently packed into a glass jar, and placed on a carriage bound for the nearby town of Ithaca.

The journey was uneventful, and the brain arrived safely at a laboratory belonging to Dr. Burt Green Wilder, where it was measured, weighed, and cataloged. Wilder, Cornell's first professor of animal biology, then added it to his unique collection of human brains.

Scientists had been trying to correlate intellect and personality with certain features of the brain in the late nineteenth century, and Wilder's collection—the first in the country—was well-known.

Wilder had little trouble collecting the brains from criminals who suffered Ruloff's fate or from deceased paupers and idiots, but data gathered from the study of these specimens could not be considered typical of the human race. So an attempt was made to induce "learned people" to bequeath their brains.

This effort went badly, however, and Wilder managed to obtain only a few educated brains before he died—leaving his own brain to the collection—in 1925.

The Cornell Brain Association, founded a few years before Wilder's death, assumed the task of caring for

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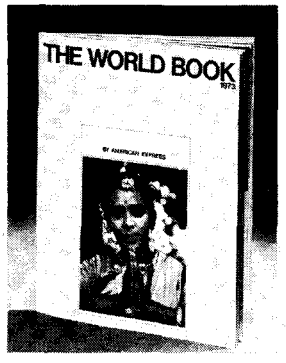

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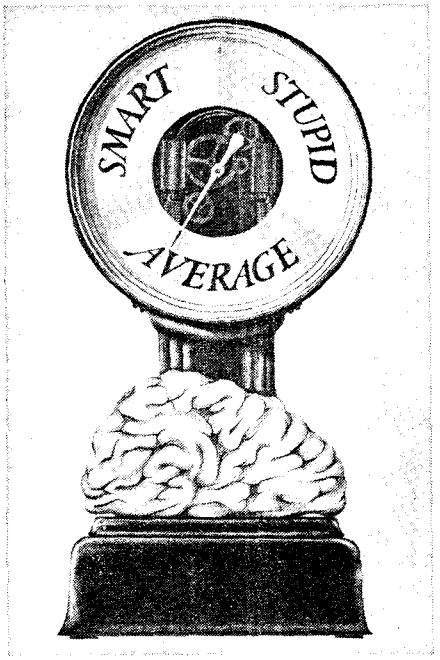
and expanding the collection, but enthusiasm for the endeavor was dismally lacking. After all, the study that attempted to correlate brain size with intellect was going out of fashion, and it was bad form for a reputable university to place undue emphasis on a scientific pursuit that had fallen on hard times. So Wilder's brain collection found itself relegated to the basement of Stimson Hall to gather dust. As time passed, though, whatever the collection had lost in scientific acclaim it gained as a curiosity.

The day came, not long ago, when it was decided to bring Wilder's brains upstairs. The decision was prompted more out of convenience than anything else: there was a need for more storage space in Stimson's basement, and nobody outside the biological sciences division could be induced to accept the collection.

Unfortunately, the brains did not store well. Only 122 remain in recognizable condition—the remainder succumbed either to the dissector's scalpel or to poor preservation, or to a combination of the two. Fourteen of the best—and most famous and infamous—were chosen for display, including Ruloff's, which still holds the distinction of being the largest, weighing nearly four pounds.

Along with Ruloff's brain are those



belonging to Helen Hamilton Gardener (a prominent women's suffrage leader born in 1853, who willed her brain "to help provide superior female brains for future research"); assorted professors, poets, and physicians; and, according to aging, albeit cryptic, index cards, several thieves, an alcoholic, and an "erotic German."

Although no fresh specimens will be accepted into the collection, it is doubtful that too many people would consider donating their brains once they've read the Cornell Brain Association's memorandum on *How to Make a Brain Bequest*. Besides the routine forms for the bequest, the memorandum suggests that the following "material," among others, be available: a person competent to remove the brain; knives, scissors, and saws; one tray large enough to hold the brain; and a tin, one-gallon can for shipping it. Everything, the memorandum emphasizes, should be ready in advance. □

Belly Button Blues

We did not think that physicians were generally attuned to women's liberation until we happened upon an article in the news journal of the New York State Academy of Family Physicians. The article, written by Martin Markowitz, the publication's editor and a general practitioner himself, follows:

Worries, worries, worries—it seems that our medical profession is preordained to be continuously plagued with new dilemmas. As if it were not enough that we must now actively concern ourselves with the spectacular advances in the field of organ transplants and the like, a new major problem now presents itself on the horizon. Having spent the summer at the beach, I can now attest to the fact that our new source of worry is the u-m-b-i-l-i-c-u-s—yes, the once lowly, neglected "belly button." And we can thank the purveyors of modern fashion for this circumstance. The etiological factor behind it all is, of course, the BIKINI.

There was a time, in the not too distant past, when a young miss had it made if she was fortunate enough to be blessed with a beautiful face and/or a well-proportioned figure. Today—this is just not enough! A girl does not begin to rate unless she can display a smooth, round, symmetrical depression in her mid-abdomen. As we now survey a "young thing" at the beach we are forced to admit that . . .

The thing that first strikes us
Is the u-m-b-i-l-i-c-u-s.

This state of affairs has now revolutionized my approach to the care of the newborn female baby. Now my *first* consideration is the umbilicus. I watch and take care of it like a piece of rare china. I clean it, I strap it, yes—*I worry over it*. I am constantly plagued with the fear that some day a sweet young thing will appear on an exclusive beach, for all the world to see, with a protruding "B.B." and she may turn out to have been one of *my* babies. □

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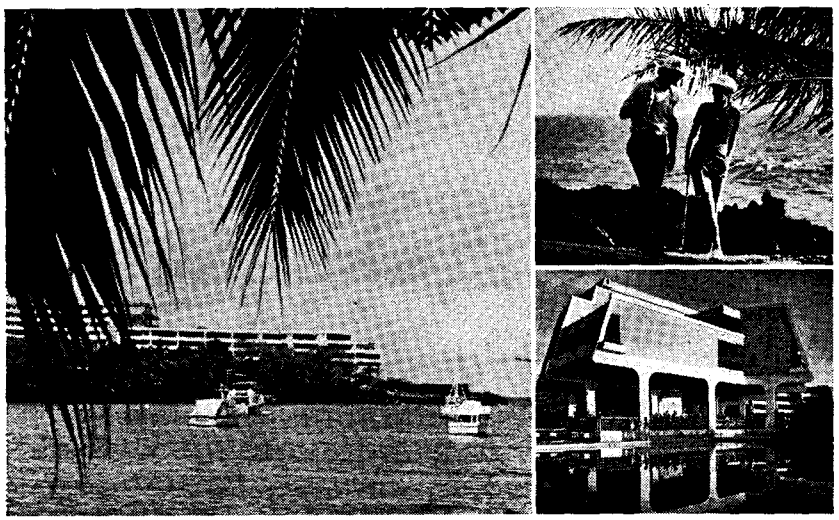

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WIT TWISTER NO. 324

Edited by ARTHUR SWAN

The object of the game is to complete the poem by thinking of one word whose letters, when rearranged, will yield the appropriate word for each series of blanks. Each dash within a blank corresponds to a letter of the word.

From simple seeds — — — — — — gardens of the mind.

To — — — — — — the Past returned when, half asleep,

Half roused from slumbrous — — — — — —, he defined

One taste long locked in Memory's dim keep.

A.S.

Answer on page 98

FRASER YOUNG

LITERARY CRYPT NO. 1547

A crytogram is writing in cipher. Every letter is part of a code that remains constant throughout the puzzle. Answer No. 1547 will be found on page 98.

IP VJSCQ XDD PB PIFSEV

XV C LXVFPMSVI TCH PB

JECXVXMY PNEVSDGSV.

TXDD LNECMI

LETTERS

Fishing for Answers
Isaac Asimov argues in his article "Land Life: A Speculation" [*SR of The Sciences*, March] that the development of land life on the earth may have been connected with the tides, and that if the moon has been captured by the earth, the sequence of events leading to land life on our planet may be an extremely rare one in the universe. His implication is that, in searches for extraterrestrial intelligence, we may have only fish to talk to. But there are two sources of tides on the earth—a lunar tide and a solar tide. The solar tide has about half the amplitude of the lunar tide. A moonless planet only slightly closer to its star would have, from solar tides alone, tides quite comparable to those on earth.

Carl Sagan
Cornell University
Center for Radiophysics
and Space Research
Ithaca, N.Y.

Knowing Your Own Mind
David Perlman's article "Sane Insane . . ." [*SR of The Sciences*, March], about David Rosenhan's pseudopatients in mental hospitals, omits an important fact: Thomas Szasz (*The Myth of Mental Illness*) has been telling us about the irrationality of the psychiatric world for 20 years. Erving Goffman (*Asylums*) also made it quite clear. Perhaps these observations will convince us of the answer to Rosenhan's question: "If sanity and insanity exist, how shall we know them?" The answer is that each individual must be free to provide his own definition of health and not be burdened by an expert's doing it for him.

Robert F. Suczek
Lafayette, Calif.

No Potion to Ward Off Senility
Mr. Albert Rosenfield's article "The Longevity Seekers" [*SR of The Sciences*, March] was an interesting and scientific discussion of the "disease" of senility. He neglected, however, to mention two vital remedies for combating this disease: use of mind and body and the fact that man is not only a material being but a spiritual being as well. I am 80 years old, subject to a long, debilitating illness, which I have overcome through my own knowledge of diet, exercise, and spiritual faith.

Alice Farnsworth
North San Juan, Calif.

If the devil (who else?) were to offer me a pacemaker chemical cocktail to extend my life well beyond the brief three score and ten, I would promptly guzzle the elixir. After all, life's first two decades are devoted to institutional sitting (school). A scant ten years later one's credibility becomes suspect. Another ten ushers in the forties, when "morality" ceases to be a merely academic issue. And at the half-century mark, retirement no longer seems the comfortably distant event it once was. In lieu of satanic assistance or medical miracles, the alternative appears to be the compression of as much intrigue, joy, and revelation as is possible into the fleeting era of existence allocated us. Whatever the case, life should always be lively.

Michael G. Driver
San Francisco, Calif.

Medical Reform Movement Needed
I share the disappointment that Dr. Willard Gaylin expresses in his editorial "The Patient's Bill of Rights" [*SR of The Sciences*, March]. The American Hospital Association's publication of patients' rights is no revolutionary document. It is simply a statement of the decency that all patients should expect. Dr. Gaylin concludes his article, however, before proposing a need for reform on a more profound level. In an era of much re-definition of social structures, the field of medicine should not be free of its responsibility to grow with society. While there is certainly a need for patients to become more actively involved in the quality of medical treatment they can expect, does not the primary responsibility rest on the moral growth of doctors and the institutions they foster?

Anne M. Stewart
West Lebanon, N.H.

One Minor After-Shock
Alan Anderson's article "Earthquake Prediction" [*SR of The Sciences*, February] caused our tiltmeter sensor system to register one minor after-shock at the statement that the North American Rockwell tiltmeter was used to stabilize the inertial guidance platform for the Apollo spacecraft. Fact is the tiltmeter was derived from the level detection device created by the company's Autonetics Division for the USAF Minuteman missile and represents a transfer or "spin-off" of defense technology to broadly useful civilian applications. Apollo was built by NR's Space Division and, sorry to say, did not use our tiltmeter.

T. K. Shuler
Program Vice-President
Autonetics
North American Rockwell
Anaheim, Calif.

War Is Unhealthy for All Living Things
Bruce Wallace's article "Conscription At Sea [*SR of The Sciences*, March] voiced one of my deepest fears. Professor Wallace cites the twisted logic of war (something like "Do double unto others what they have done unto you") and goes on to suggest that this logic could lead to the intentional slaughter of marine animals. Rather than sicken and kill these creatures with our distorted institution of war, we should follow their most excellent example of social unity. Professor Wallace's idea to prohibit the use of marine animals for military purpose should certainly be adopted immediately. Such a prohibition should be extended to all animals—*Homo sapiens* included!

Susan Shane
Chevy Chase, Md.

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Survival in the African Jungle
Whether Jane Goodall will admit it or not, the fact remains that her life is, in itself, an advocacy of "women's liberation" ["Beauty and Her Beasts," *SR of The Sciences*, February]. That this "intensely feminine" and "ethereal" woman was able not only to survive but to flourish in the African jungle alone *is* a feminist accomplishment. Dr. Goodall is the epitome of what women desire and expect from life—the freedom to express their own abilities and to do work that is both rewarding and constructive.

Lucille Bertuccio
Hopewell, N.J.

Confused Computers
Roger Rapoport's article "Electronic Alligators" [*SR of The Sciences*, March] was both amusing and intriguing. I thought the bizarre ways to use computers that were depicted in this article only appeared in TV reruns of *Man From* UNCLE, but still we continue the relentless and vain search to design a computer in the image of a human being. The $5.9 billion used to promote these "animals" is indeed staggering. Hopefully, the industry will realize that the computer, in a sense, is a finite instrument and, although it has proven itself worthy in the majority of its applications, may physically fold when faced with the many variables of a security system.

Mark Balawejder
Programmer-Analyst
Bell of Pennsylvania
Philadelphia, Pa.

Bear With Us, Smokey
Richard Vogl covered the beneficial effects of fire quite accurately in his article "Smokey's Mid-Career Crisis" [*SR of The Sciences*, March]. Smokey should, however, continue to play a continuing role in fire prevention. Amateurs should not be led to believe that any fire they start in the woods will be beneficial—many wildfires can result in the loss of human life and property. Professionals should be the only ones entrusted with the use of fire as a management tool. Mr. Vogl also failed to note that through logging in the forest, the same advantages of better wildlife habitat and desirable tree species can be obtained without the waste of the resource (trees) and without the creation of air pollution from fire.

George Fowler
Associate Editor
The Northern Logger
Old Forge, N.Y.

Chewing Over the News
After reading Roger Field's article "Edible Newspapers" [*SR of The Sciences*, March], about the experiments to convert old newspapers to food, a scene in the home of the future comes to mind.

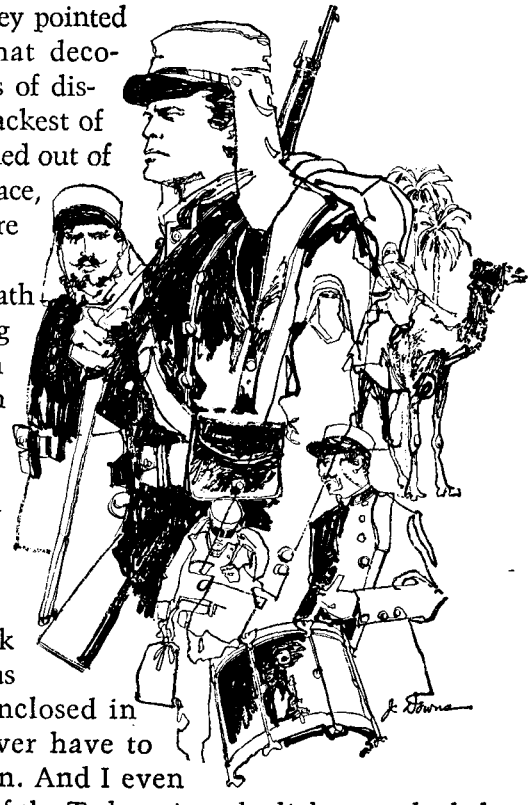
Mom: Your breakfast serial is read-y. Come now, eat your words. It's a literary digest, just food for thought.
Child: It's hard to swallow some of this stuff.
Mom: A-menu to that!

Eden Arin
West Palm Beach, Fla.

"You're a disgrace to the regiment," they said as they tore the stripes from my arm.

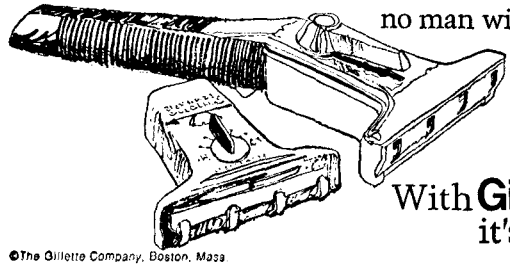
"Good-bye NICK"

My name was Pierre Ettienne La Rogue. But my fellow officers in the French Foreign Legion called me, "Nick." I can still hear their jeers as they pointed to the shaving nicks that decorated my face like medals of dishonor. And then that blackest of black days—I was drummed out of the Legion. "You're a disgrace, Nick," they said as they tore the stripes from my arms.



I wandered alone beneath the desert stars, pondering my fate. Suddenly, at an oasis, a mysterious bedouin slipped me a Gillette Techmatic® razor. I turned the lever to adjust it to my own individual face and beard. I discovered that instead of blades with sharp corners that can cut and nick my face, there's a continuous razor band. All safely enclosed in a cartridge so I will never have to touch a sharp edge again. And I even noticed the different feel of the Techmatic...the lightness, the balance. And I knew I would always get a smooth, safe shave.

I was restored to my regiment with honor and became known as "Pierre of Pakistan." And as long as there is a Gillette Techmatic... no man will ever again call me "Nick."



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it's good-bye Nick

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EDITORIAL

Drowning in Data

Proponents of science, I among them, often characterize it as a noble, vitally important quest for knowledge. On occasion, however, it occurs to me that the quest may have been entirely too successful. Science, to put it bluntly, is in very real danger of drowning in its own output.

Scientific and technical literature rolls off the presses at a rate of 60 million pages per year. In the last 100 years, according to Robert S. Daniel, professor of psychology at the University of Missouri, 400,000 titles have appeared in the field of psychology alone. Daniel adds that this output, when compared with that of the medical, biological, or chemical sciences, is relatively small. And the situation will probably get worse before it gets better, because our rate of knowledge acquisition is accelerating. By the time a child born today is 50 years old, said Robert Hilliard, an educational broadcasting expert for the Federal Communications Commission, "97 per cent of everything known in the world will have been learned since the time he was born."

Every time this point is made, there seems to be a loud voice shouting from the wings: "But what about the computer?"

Granted, it is conceivable that the bulk of scientific data could be stored in a computer and that a scientist, wanting to know what has been discovered about a particular atomic particle, for example, simply could push a few buttons and receive a near-instantaneous outpouring of pertinent information. But here is where the problem arises. As Emilio Segree, a Nobel Prize winner in physics, has stated, "On K-mesons alone, to wade through all the papers is an impossibility." How, then, does one separate the gold from the dross?

Weeding out the trivial and irrelevant in scientific literature is not a new problem. Consider, for example, the plight of Gregor Mendel, the Augustinian monk who is now regarded as the father of genetics. In the mid-nineteenth century, about the time Darwin published his *Origin of Species*, Mendel was tending his garden in Brno in what is now Czechoslovakia. Mendel was a botanist: he grew peas. He was also a mathematician: he counted the peas he grew. Mendel noticed that even when he crossed a tall pea plant with a short one, he got only tall pea plants. In effect, he discovered that some characteristics (such as tallness in pea plants) are dominant, while others (such as shortness) are recessive. He published his findings in the *Proceedings of the Natural History Society of Brno*. The point is that Mendel's findings could have cleared up one of the major scientific questions of the time—had the right person read and understood his paper. Darwin's theory of evolution had one serious flaw. It could not explain why, if a superior horse was bred with an inferior horse, the result was not an average horse. Natural selection required that the result be a superior horse, but Darwin could not explain the mechanism that brought this about. While the controversy over this problem raged, Mendel's paper remained unnoticed. Not until 31 years after its publication, after Mendel had died, did science discover that an explanation of the mechanisms for natural selection lay buried in the scientific literature.

Isaac Asimov has a theory to explain why Mendel's paper was overlooked for so long. "It was a paper with a biological title," he says. "It dealt with pea plants. Therefore, physicists and chemists and people like that wouldn't look at it. The title alone threw them off. Biologists might have looked at the paper because of the title, but as soon as they saw the contents, they would have seen a series of numbers, some of which contained as many as three digits. Now in those days biologists didn't involve themselves with such higher mathematics, and as soon as they saw those three-digit numbers, they passed the paper by—with the result that there was nobody to look at it, and nothing happened. It just stayed there."

Now, what about a paper recently printed in *Physical Review Letters*, a publication of the American Physical Society? It is titled "Impact-Parameter Dependence of K-Shell Coulomb-Ionization Cross Sections." After reading the paper, I can honestly say that I have no idea of what it is about. Of course, this is not to say that the paper is invalid or that it will not be extremely important to physicists. But what if there is a tiny bit of data buried in this paper, some offhand comment that could radically change the thinking of geologists or oceanographers or even plastic surgeons? Would this piece of information lie fallow for a generation, like Mendel's notions of dominant and recessive traits?

This is the problem; no one yet has a solution.

Some people have suggested cutting back or even halting the flow of scientific literature. An extreme step, for example, would be to declare a moratorium on scientific publications for a decade or so. However, this is a feeble alternative, if an alternative at all. First, it is doubtful whether the already-published material could be successfully weeded even in a decade; who is qualified to tell the gold from the dross? Furthermore, some genuinely important advances would be lost, perhaps forever. A more viable solution would be to stop encouraging the endless outpouring of trivial or redundant data. Clinging to the "publish or perish" dictum, universities are the worst offenders on this count. No longer should the sheer weight of an instructor's publications be used as a gauge for academic advancement.

Another tack would be to develop some means of handling the enormous amount of scientific data produced. The computer again surfaces as a possibility; perhaps advances in cybernetics will someday provide a viable means of culling the trivial from the important. I would not, however, hold my breath until that day arrives.

The most reasonable solution, at least for the interim, would be to train a new kind of scientist—a "synthesist" rather than a specialist, one who could read and understand "Impact-Parameter Dependence of K-Shell Coulomb-Ionization Cross Sections" and explain it to anyone who needed to know. At present the professional science writer attempts—with occasional success—to fulfill this function.

Even if a viable solution does emerge, however, our problems are not quite over. There is still the question of the way data is used. The often-told story of the scientist and the flea accurately poses the problem:

It seems there was a scientist who trained a flea to jump at the sound of a bell. After each jump he would pull a leg off the insect. When the poor creature had only one leg left, the scientist rang the bell and the flea flopped over feebly. Then the scientist removed the remaining leg and rang the bell. The insect did not move at all.

The scientist's conclusion: When you remove all the legs from a flea, it goes deaf.

FRANK KENDIG

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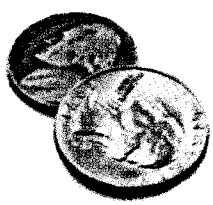

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The Ice Age Cometh

GLACIERS ARE GROWING, WARMTH-LOVING ANIMALS ARE MOVING SOUTH, AND WE ALL MAY BE GETTING COLDER BY AND BY.

BY JAMES D. HAYS

This January the temperature in the country's heartland seemed colder than anyone could recall, aggravating an already chronic fuel shortage. Schools closed in Denver, factories shut down in the Midwest, and thousands of workers were laid off as fuel supplies ran out. The suspicion that winters simply are getting colder is no longer merely a suspicion among climatologists. Over the last 30 years permanent snow on Baffin Island has expanded. Pack ice around Iceland in the winter is increasing and becoming a serious hazard to navigation. Warmth-loving armadillos that migrated northward into the Midwest in the first half of this century are now retreating southward toward Texas and Oklahoma. Russian crop failures are on the increase.

These are just some effects of a global cooling that has been recorded by the world network of weather stations. If all indications are correct, worse is yet to come. Judging by what has happened in the past, it may very well get cold enough to allow great glaciers thousands of feet thick to cover North America as far south as Long Island, burying the highest peaks of the White Mountains and Adirondacks.

The last such glacial advance—the last great Ice Age—ended only 17,000 years ago, when the ice sheets in the mid-latitudes retreated, leaving only some smaller mountain glaciers as they crept back to the poles (where now all that remains are the ice packs on Antarctica and Greenland). As the ice melted, the earth then rapidly warmed until sometime between 3,000 and 5,000 B.C., when it was probably warmer than today—in fact, warmer than it had been for 100,000 years. But these balmy conditions were not long lasting, and the climate gradually cooled until about 900 B.C., during the archaeological Iron Age. It then rebounded again, as evidenced by records of flourishing vineyards in England from 1000 to 1200 A.D. Thus, the great Viking conquests were favored by slightly warmer conditions than today's. This time of mild climate and flourishing agriculture saw the spread of Christianity over northern and eastern Europe and the most active period of cathedral and abbey construction.

The climate again cooled from the late fifteenth through early nineteenth centuries. This interval, the so-called Little Ice Age, was a refrigeration of considerable intensity, although still a far cry from a full ice age. It saw the greatest advance of mountain glaciers, and probably of ice on the polar seas, since the last great Ice Age. In some degree it touched every aspect of human life.

The effects of the Little Ice Age have commonly been overlooked, presumably because they were overshadowed by the devastation caused by the Black Plague. The late 1500s and the 1600s were probably the coldest time of the four-century period. The 1690s saw the last serious famine anywhere in Great Britain, the result of an eight-year run of harvest failures in the upland parishes of Scotland, where the proportion of the population that perished from hunger rivaled the toll caused by the

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Black Plague. The consequent weakening of the Scottish nation may have made union with England inevitable.

In England the fifteenth through nineteenth centuries also were significantly colder than now. The Thames River at London had frozen only occasionally prior to the sixteenth century; however, in that century, and during the two that followed, the river froze on numerous occasions. In the late 1600s the river froze repeatedly, and for weeks on end in the winter of 1683–84, Charles II, his court, and just about everybody else in London were able to tread clear across the ice-encrusted Thames. The river froze on only one occasion in the nineteenth century, but what prevented it from freezing more often probably were man-made changes of the river banks and subsequent industrial thermal pollution, rather than climatic warming. The Little Ice Age also affected the Scandinavian colony on Iceland, where grains introduced by the Vikings refused to grow.

On this side of the Atlantic, good historical records don't go back as far, but there is some striking evidence from the eighteenth and early nineteenth centuries that conditions were significantly colder in eastern North America than they are today. In the winters of this period New York Harbor repeatedly froze, allowing Staten Islanders to walk across the narrows to Brooklyn. In 1816 there was frost every month in northern New York and New England, and for this reason it was dubbed "the year without a summer." From the sixth to the nineteenth of June subfreezing temperatures were recorded in upstate New York and New England, and a foot of snow fell on Quebec City. The crop losses that occurred because of this late-spring cold and the following late-September black frost posed serious problems for Americans recovering from the ravages of the War of 1812. Admittedly, 1816 was unusual, even for the Little Ice Age, but the possibility of the recurrence of such anomalous years increases as the world's mean climate cools.

Our knowledge of climatic conditions before the late 1600s, when the thermometer was invented by Gabriel Fahrenheit, is based mainly on observations included in diaries and historical accounts. For the next 150 years we have a temperature record for western Europe and, during the latter part of this period, for North America. By the end of the last century a sufficient number of weather stations had been set up around the world to provide a good indication of global climatic trends.

This climatic record clearly shows the end of the Little Ice Age, with temperatures rising from the late 1800s until about 1940. Since then the trend has reversed, and a steep decline is now clearly underway. Already the climate has reverted to the levels of the 1920s, and the cooling continues.

The effects of the present cooling trend will be most strongly felt in temperate climatic zones, while the tropics will be least affected. Not only will the temperate regions become cooler, but we may also expect an increase in "anomalously" cold years—years with late-spring frosts or early-fall frosts —and a general increase in storminess. Thus, the grain fields of the Canadian prairies and the Russian steppes are vulnerable to a shortening of the growing season; however, the sugar cane harvest of Cuba or the banana crops of Guatemala would probably survive even a fully glacial climate in the north.

It is the vast industrial and grain-producing areas that will undergo the greatest change. The main grain (primarily wheat) exporting nations—the United States, Canada, Argentina, and Australia—all lie in temperate latitudes. A large number of nations, most notably the Soviet Union and China, rely upon these exports. Any reduction of grain production could cause an immediate problem, for the large grain surpluses of some years ago have now been vastly reduced, and most of the world's production is consumed within a year of the harvest. The continuing population growth may put a strain on our food resources even without a marked modification of climate, but a shortening of the growing season in temperate latitudes could easily aggravate this situation.

As climate cools, the demand for more heat will put an ever-increasing strain on our energy resources, causing natural gas, oil, and electricity prices to rise. The present "energy crisis," though partially caused by archaic regulatory procedures, points out how narrow our tolerances are and how closely we regulate our energy supplies to the level of so-called normal winters. However, what was considered an abnormally cold winter is becoming normal, and it is expected that winters will be getting even colder. Some scientists, such as the Czechoslovakian climatologist Jiri Kukla, think we may be on the verge of another Great Ice Age. They point to the fact that previous interglacial mild intervals, which are comparable in warmth to the present one, lasted only about 10,000 years. The present interglacial period already has lasted 10,000 years, so if it is truly similar to earlier ones —and if man's activities do not alter the natural trends—it should be nearly over.

If we indeed have reached the critical point in the climatic cycle where an interglacial changes to a glacial, there is some difference of opinion as to how long this interim period will linger. Recent evidence suggests a shorter time for the transition than was previously thought. Pollen grains preserved in the peat bogs of Macedonia, Greece, reveal that the change from the last interglacial forest to glacial grassland probably took no more than a few hundred years. A comparable length of time was required for the temperate forests of England, the Netherlands, and Denmark to be replaced by subarctic tundra. However, the magnitude of the change from an interglacial to a glacial is such that noticeable changes, even greater than those observed in the Little Ice Age, would probably occur in fewer than 100 years.

Other scientists, such as the British climatologist Hubert Lamb, propose that the present climatic trend may lead us only into another Little Ice Age. They argue that climate appears to oscillate periods of about 200 and 400 years. The coldest part of the Little Ice Age was in the late sixteenth and seventeenth centuries. Another cold spell, though less severe, came in the early nineteenth century. If the system continues to cycle as it has in the past, we can expect substantial cooling in the late twentieth and early twenty-first centuries, perhaps to a degree comparable with the Little Ice Age. On the conservative side, the Danish physicist W. Dansgaard, from his re-

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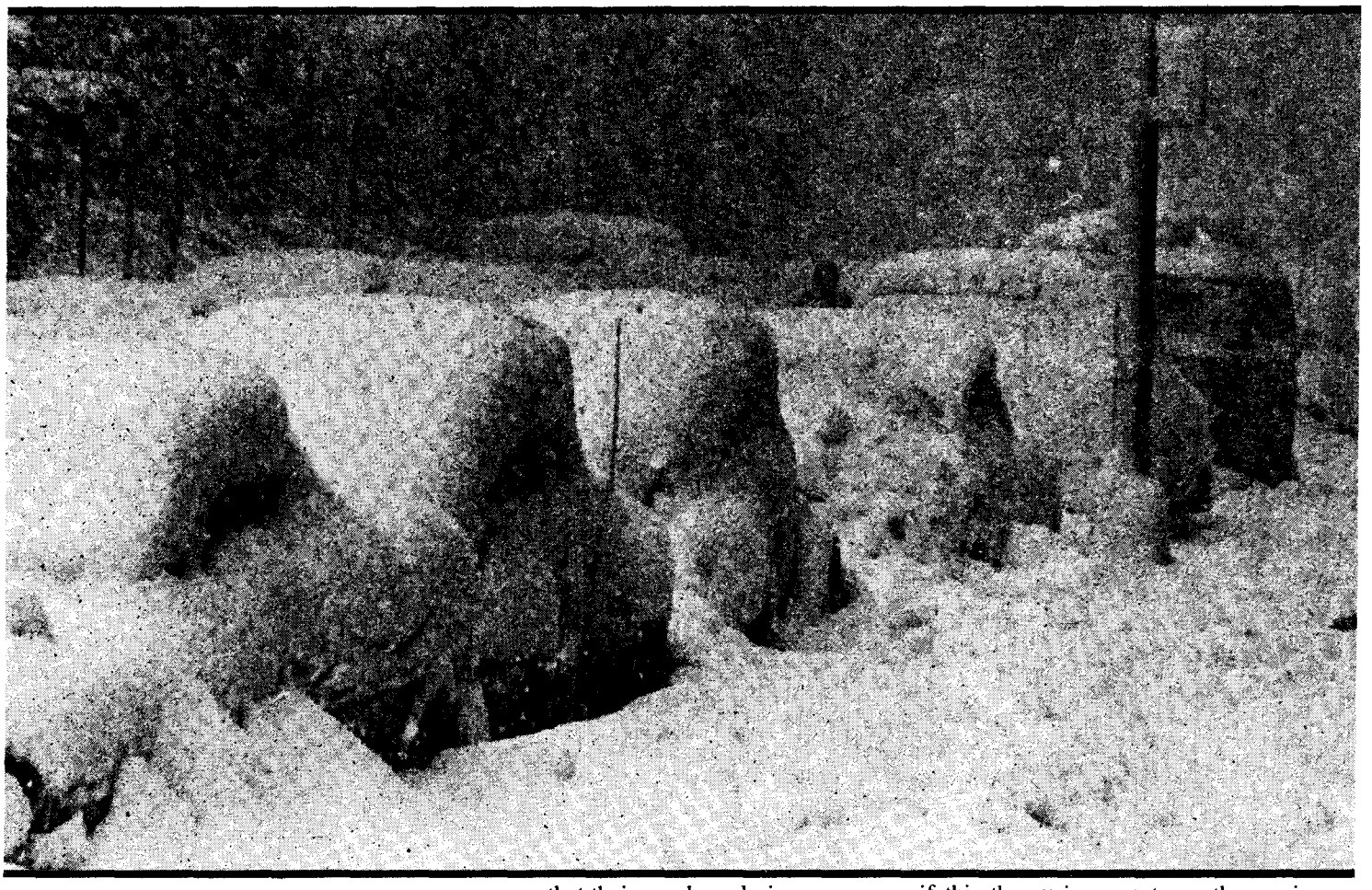
search into the climatic record of long columns of ice removed from the Greenland ice cap, predicted that the present cooling trend will probably continue for only another 10 to 20 years.

The most reasonable explanation for the current global cooling is that the amount of solar energy reaching the earth's surface is decreasing. Since the sun is the source of all the energy in natural climatic processes, anything that interferes with the amount of solar energy received and retained at the earth's surface or the distribution of that energy could cause a change of climate. An obvious way this could happen is through a fluctuation of the strength of solar radiation at the sun's surface. However, evidence to document this fluctuation is difficult to come by. Since atmospheric variations cause changes in the strength of solar radiation at the earth's surface, we must either monitor the sun's strength above the atmosphere (which has yet to be done) or rely on observations of solar disturbances that may reflect changes in solar intensity.

Sunspots, one of several kinds of solar disturbances, have the longest record of reliable observations, dating back to the 1600s. Some correlation has been found between large numbers of sunspots and warmer conditions on earth, and a dearth of sunspots and cooler conditions. It has not been established, however, that their numbers during any year are an accurate measure of solar energy output. Solar disturbances other than sunspots have not been measured over a long enough period for scientists to say how important these changes in solar intensity may be to the overall process of climatic change. It seems incredibly shortsighted that, during our entire space program, no instrument was placed outside the earth's atmosphere to monitor long-term variations of the sun's total strength.

Gravitational interaction between the earth and other bodies in the solar system also causes periodic changes in the geographic and seasonal distribution of incoming solar radiation. This mechanism does not significantly alter the annual total radiation received at any given portion of the earth's surface. Nevertheless, the relative increase of radiation received in one season at the expense of others may be extremely important in the building and decay of glaciers. This theory is a popular explanation of the major advances of ice sheets. Over the last quarter-million years, glaciers have expanded during times when summers were cool and have retreated when summers were hot. At present, the northern hemisphere has passed from a time of sharp contrast among the seasons and is experiencing what is called a low seasonal contrast regime—possibly signaling, if this theory is correct, another major advance of ice.

Alterations in the transparency of the earth's atmosphere also affect the amount of solar energy reaching the earth's surface. Large volcanic eruptions, such as the eruption of Krakatau in 1883, can inject tons of fine rock material and gases high into the upper atmosphere, 15 miles and more. Fine particles that reach such levels above the weather may take years to settle out. In general, temperatures for a year or so after such great eruptions are somewhat colder than the average for the decade in which the eruption occurred. Thus the extraordinarily cold summer of 1816 may be at least partially explained by the mighty volcanic eruption of Tamboro, Sumatra, in 1815. However, the long-



The last climatic warming trend ended in the early 1940s. Our planet has been getting steadily colder ever since.

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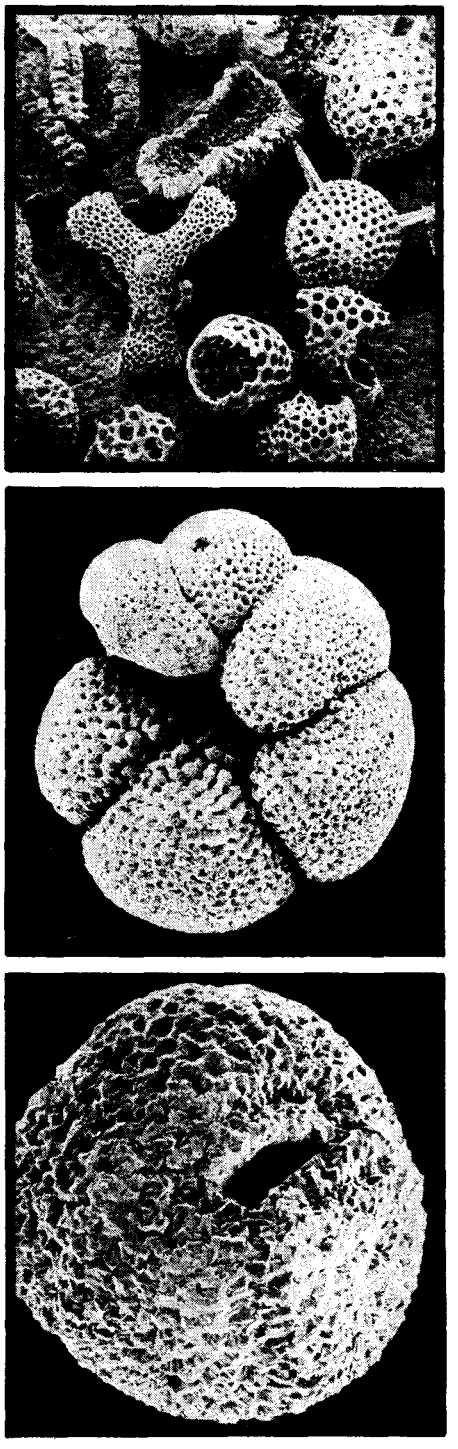
term development of climate seems to be only slightly modified by volcanic eruptions.

The problem of understanding the future course of climate is compounded by the possible disruption of climate's natural progression by man. Although the direct effect of man's activities on global climate is the subject of controversy, his effect on local climate is established, and his ability to affect global climate is at least probable. Man has altered local climate through construction of cities, deforestation of millions of acres, and the development and expansion of agriculture. His potential for wider alteration of climate lies primarily in modification of the atmosphere through the combustion of fossil fuels. Such combustion produces carbon dioxide and thus increases the carbon dioxide content of the atmosphere. This results in a blanket effect, reducing the heat loss from the earth to outer space and thus causing the earth to warm.

Industrial exhausts also add dust to the atmosphere. This industrial dust has a cooling effect; it screens out solar radiation just as volcanic dust does. The warming trend from the late nineteenth century to 1940 could have been caused by an industrial increase in atmospheric CO_2 and the cooling since 1940 by an increase in man-made atmospheric particles. However, it is hard to separate climatic changes that are induced by man from those that are natural. Murray Mitchell and Steven Schneider of the National Oceanographic and Atmospheric Administration have stated that, up to this point, the CO_2 warming effect and the maximum-particle cooling effect turn out to be very nearly equal and opposite, thus tending to cancel one another out. Therefore, the observed climatic trend is probably natural. Yet Mitchell and Schneider do not imply that this will continue to be the case in the future. Increased pollution or direct injection of pollutants into the stratosphere by such large high-flying aircraft as the SST could tip the balance.

To understand long-term climatic change, we first need to know how climate has changed globally in the past, not just for one hundred years but for thousands of years. As part of the International Decade of Oceanographic Exploration, which began in 1970, a unique research project called CLIMAP (Climate Long-Range Investigation Mapping and Prediction) has been started in order to fill this gap in our knowledge. A consortium of scientists working on this project is reconstructing the global pattern of climatic change through the last several hundred thousand years.

This multidisciplinary group, primarily from Columbia University's Lamont-Doherty Geological Observatory, Brown University's Department of Geology, and Oregon State University's Department of Oceanography, is reading the climatic record in layers of sediment that continuously collect on the ocean floor. Preserved in the long columns of these sediments raised from the ocean floor by oceanographic ships are the fossil remains of minute shells from microscopic organisms that once lived in the surface waters of the ocean. When alive, these organisms were delicately adapted to a narrow range of temperature and to other physical and chemical properties of the water they lived in. Climatically induced changes in these properties caused changes in the kinds of organisms that lived in any part of the ocean.



Sediments raised from the ocean floor contain fossilized skeletons of microscopic organisms from which scientists can determine the temperature of the ocean's surface thousands of years ago. The radiolarian shells, shown in the assemblage at top, once contained animals that were uniquely adapted to a narrow temperature range. Foraminifera, which have calcareous skeletons, are also useful in climate studies; the middle picture shows a warm-water "foram," and the lower enlargement is a cold-water counterpart. By studying which species prefer warm or cold temperatures, scientists can estimate past climatic conditions.

By means of mathematical techniques these fossil data can be transformed into estimates of past sea surface temperatures and other properties of the creatures' environment. These studies from all the world's oceans will, for the first time, accurately record past climatic change over thousands and hundreds of thousands of years. This detailed world record then can be used to test various theories of climatic change and to predict future trends, either theoretically or by analogy with the past. These data also may be used to predict which areas of the globe will be affected and to what degree they will be affected.

CLIMAP is an important step toward an understanding of climate, but much more is needed in both basic and applied research, particularly in such interlocking fields as meteorology and oceanography.

The possibility of a future significant climatic shift, with its consequent impact on our food and energy resources, emphasizes the pressing need to understand the causes and mechanisms of climatic change. Like many other environmental problems, climate is international, and the adjustments that must be made in order to deal with a changing climate will affect many nations. The manner in which we will adjust requires long-term planning. Perhaps this planning should logically fall under the jurisdiction of the new United Nations program for safeguarding the human environment headed by the Canadian industrialist Maurice Strong.

In any case, this past winter, when America shipped millions of tons of wheat to Russia and lowered its thermostats to conserve dwindling fuel reserves, should remind us, not only that we are living close to the limits of our resources under present climatic conditions, but also that our climate is changing—and could change substantially. □

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Memoirs of a Conference Voyeur

BY DANIEL S. GREENBERG

One of the least visible but most bitterly mourned consequences of the current drought in federal research funds is a recession on the international conference circuit, a social-professional institution as integral to science as the lab coat. As a longtime journalistic voyeur of the circuit, I appreciate the sense of loss.

That the practitioners and hangers-on of science must periodically communicate face to face is as incontestable to the trade as the second law of thermodynamics. However, the trappings of these confrontations provide some valuable insights into the lifestyle of science, which, in contrast to its substance—i.e., what scientists are doing in the lab and what it portends—is a matter infrequently discussed.

The difference between science and the rest of the world in this regard is that, while personal and societal benefits might ensue from the taxi drivers or delicatessen operators of New York, Paris, and Warsaw assembling to compare professional notes, governments do not stand ready to foot the cost of bringing them together. But since science is the ward of governments everywhere, the predilection of scientists for gathering together normally has been accepted as part of the price, though of late the stay-at-home scientific illiterates who dispense the travel funds have gotten crotchety and have been asking, "Is this trip really necessary?"

Well, the answer isn't simple, for the conference circuit is both more and less than it purports to be.

One of the cardinal propositions of conference circuitry is that, at best, someone else foots the bill for travel and lodging; at worst, the journeyer can write it off as a tax-deductible professional expense. But even more fundamental is the proposition that the assembly point must have delicious qualities, since a scientist who would not walk across campus to confer with an assemblage of visiting colleagues in many instances will feel impelled to be present if the meeting is set in the vicinity of the Adriatic Coast, the hills of Jerusalem, or the wintertime waters of the Caribbean.

Precise evidence of the drawing power of attractive sites can be found in the registration figures for the annual meeting of the American Association for the Advancement of Science (AAAS), the nation's largest scientific society. Assembling in Dallas in 1968, the AAAS drew 3,637 registrants; the following year, in Boston, registration totaled 7,891. Boston's large science-related population suggests some reason for the disparity but surely does not explain the more than doubling of registrants from one year to the next.

Researchers into these matters are alert to the imminence of a crucial test that will occur in June, when the AAAS assembles in Mexico City. Current forecasts of attendance run as high as 7,000. Considering the distance involved, this is an impressive figure when compared with the 6,607 that registered for last December's AAAS meeting in Washington.

One of the unresolved dilemmas of conference circuitry is that, while it is easy to draw the conferees to an attractive spot, it is often difficult to get them to sit still and pay attention to the purpose for which the conference was convened. Partial resolution has been achieved through a combination of attractive sites and isolation. Put simply, this amounts to luring them out and then locking them in.

One of the most heavily used sites on the circuit is the Airlie Foundation, some 40 miles from Washington, located on over 1,000 rolling acres near Warrenton, heart of Virginia's horsy-set country. Run by a storybook Texan, Murdock Head—who by age 32 held degrees in medicine, dentistry, and law—Airlie holds the lure of Washington for faraway conferees but is really too far away for a convenient night out in the capital. "Doc" Head calls it a "talent trap." Of course, Washington hotels abound with conference facilities, but even when the conferees are drawn mainly from the metropolitan area, many conference organizers prefer to spare them the temptation of showing up and then playing hooky.

Coming up fast on the conference circuit is Reisensburg Castle in the south of Germany, a meeting facility operated by Ulm University. Sounds fine, but once there, there's nothing to do but confer. Perhaps not unmindful that conferees get bored when they are confined to conferring, the castle's managers throw in a winetasting or two, plus a bus tour of nearby sights.

The formal business of most conferences is the recitation of papers that could just as easily be committed to print for interested readers. And in time they almost certainly will, whole or in bits and pieces, for the difficulties becoming visible in today's crowded and competitive world of science necessitate adoption of the first principle of the meat-packing industry—never throw anything away.

But far more important than hearing papers read is the opportunity for developing personal links, sniffing out the job market, placing graduate students, and exchanging gossip that no prudent scientist would commit to paper or the telephone. Scientists, in perhaps uncommon amount, possess the quality of praising in public and libeling in private. All of which accounts for the often-made comment that the conference wasn't very good but a lot of useful talk took place in the corridors and during coffee breaks.

Since conventions and conferences are widely celebrated as arenas for extracurricular personal relations that spouses might frown upon, the question arises as to whether the scientific fraternity makes extensive use of its travels for this purpose. The answer is that the "groupie" syndrome, personified by adulatory novices of science flocking around the luminaries of the frontiers of knowledge, is not unknown on the conference circuit; nor is it unknown for a grant-subsidized traveler to arrive at some distant meeting place with a woman not his wife. But by and large, one gets the impression that scientists tend to be among the "straighter" elements of American society. It has been privately confided, in fact, that a few years ago, when the officers of a major scientific society were seeking to make their usual booking of a large Washington hotel, the management there bluntly told them that the "girls" working the lobby had bitterly complained about the lack of business from the society's members.

Well, more and more grants are coming out with the provision that expenditures are not authorized for international travel without the granting agency's explicit permission—which is indeed hard to come by. Whether science will suffer is uncertain, but there is no doubt that its lifestyle is being crimped. □

Daniel S. Greenberg is Washington editor of SR of The Sciences.

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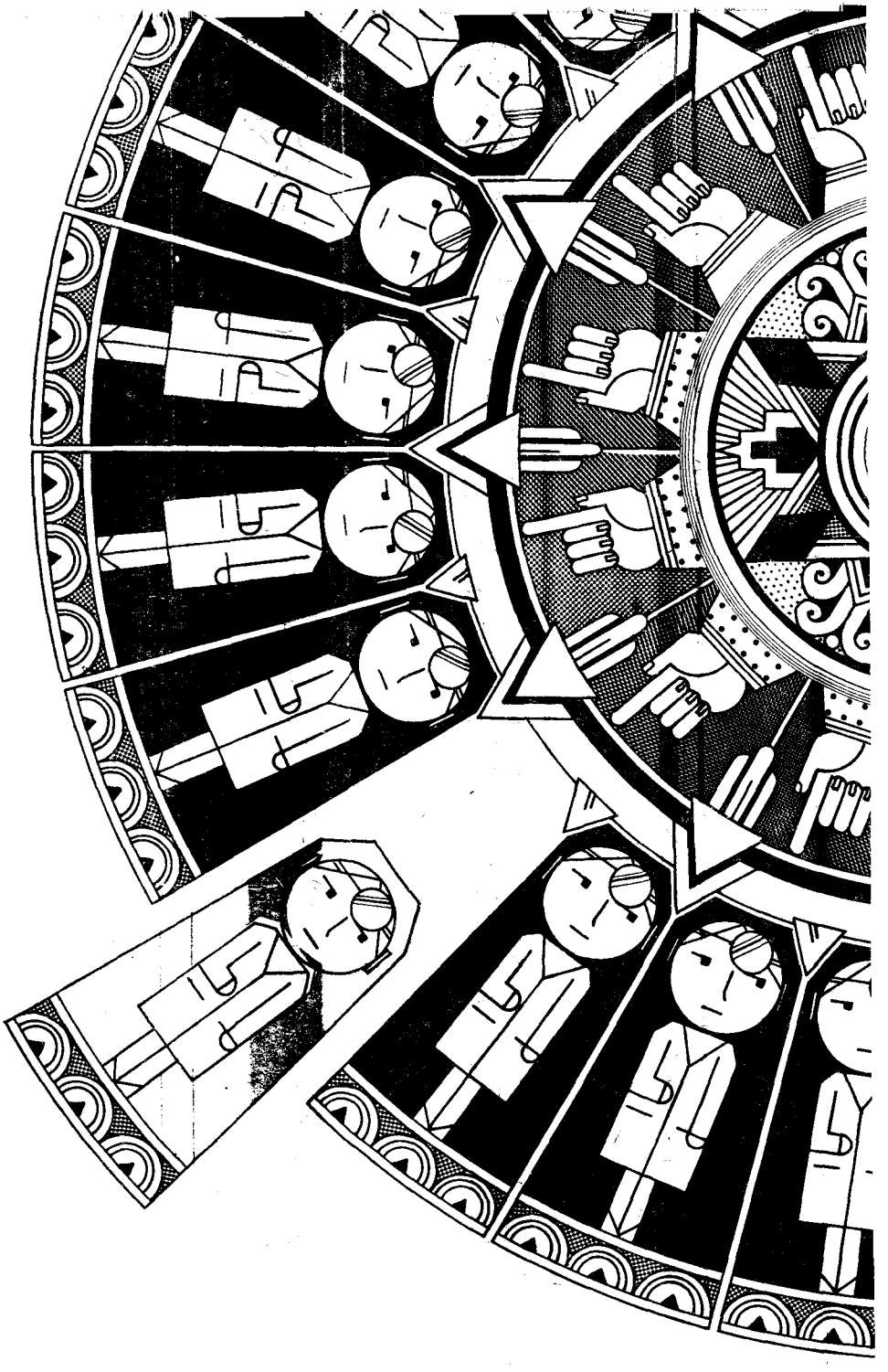
CHOOSING A DOCTOR

IS COMPETENCE THE PRIME CRITERION? PHYSICIANS AND THEIR PATIENTS OFTEN DON'T AGREE.



BY STEPHEN P. STRICKLAND

There is no difficulty in choosing a doctor in my hometown in Alabama, a pleasant, semirural community some 20 miles northeast of Birmingham. Only one physician practices there. Other doctors are within reach, however. Closer to the city, where the inevitable ring of shopping centers begins, there are as many doctors' offices as barber shops.

Our town's single medical practitioner knows most of his 2,000 neighbors. He knows their medical histories and their personal inclinations about calling the doctor. He has developed a keen sense of what is and what is not an emergency; and when he feels he is genuinely needed, he makes a house call. Otherwise, he diagnoses and prescribes and comforts a steady stream of patients in his office. When surgery is necessary, he operates in a hospital 12 miles away.

The townspeople do not generally think of the doctor in those saintly or heroic terms sometimes applied to physicians in isolated communities. But he is respected. Most people think he's a fine doctor, and they go to him when they feel they need medical attention. It is an easy and not unhappy choice.

People living in those 134 counties in the 24 states in the country where no physician presently practices would probably say that the real issue of physician choice is having a doctor choose a community. To have even one nearby "option" would be, to them, a matter of good fortune. But most Americans are not so constrained in choosing a doctor. In fact, for many, the first difficulty lies in the number of physicians who are at least theoretically available, rather than the absence of them. In what is surely typical of other large metropolitan areas, the listing of physicians in Washington, D.C., takes up 21 of the phone book's Yellow Pages.

In that same section of the Yellow Pages are listed physician referral services—some are operated by county medical societies of adjacent areas. The referral bureaus can help narrow the choice, providing on request the names of three physicians who are located relatively near the person seeking one and referring specialists if the need for one is immediately clear. The physician referral services seem to be regularly used. In one Washington suburb the sponsoring medical society reports that within a year after its initiation, the physician referral bureau was answering up to 2,000 requests per month.

The thought of "choosing" a doctor usually arises only when people are sick. Then they want one quickly. Only about 1 in 20 of those calling the suburban referral bureau for help in finding a doctor took the time to ask for details that might have told something of a physician's training and qualifications: e.g., where and when he got his M.D. degree and with what hospitals he was affiliated. The referral bureau will provide such information on request.

While doctors usually hang their diplomas on their office walls, on the whole, they feel it unnecessary to provide patients with further evidence of

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Stephen P. Strickland directs research and policy studies in Washington for the University of California's Health Policy Program. He is the author of several books, including Politics, Science and Dread Disease.

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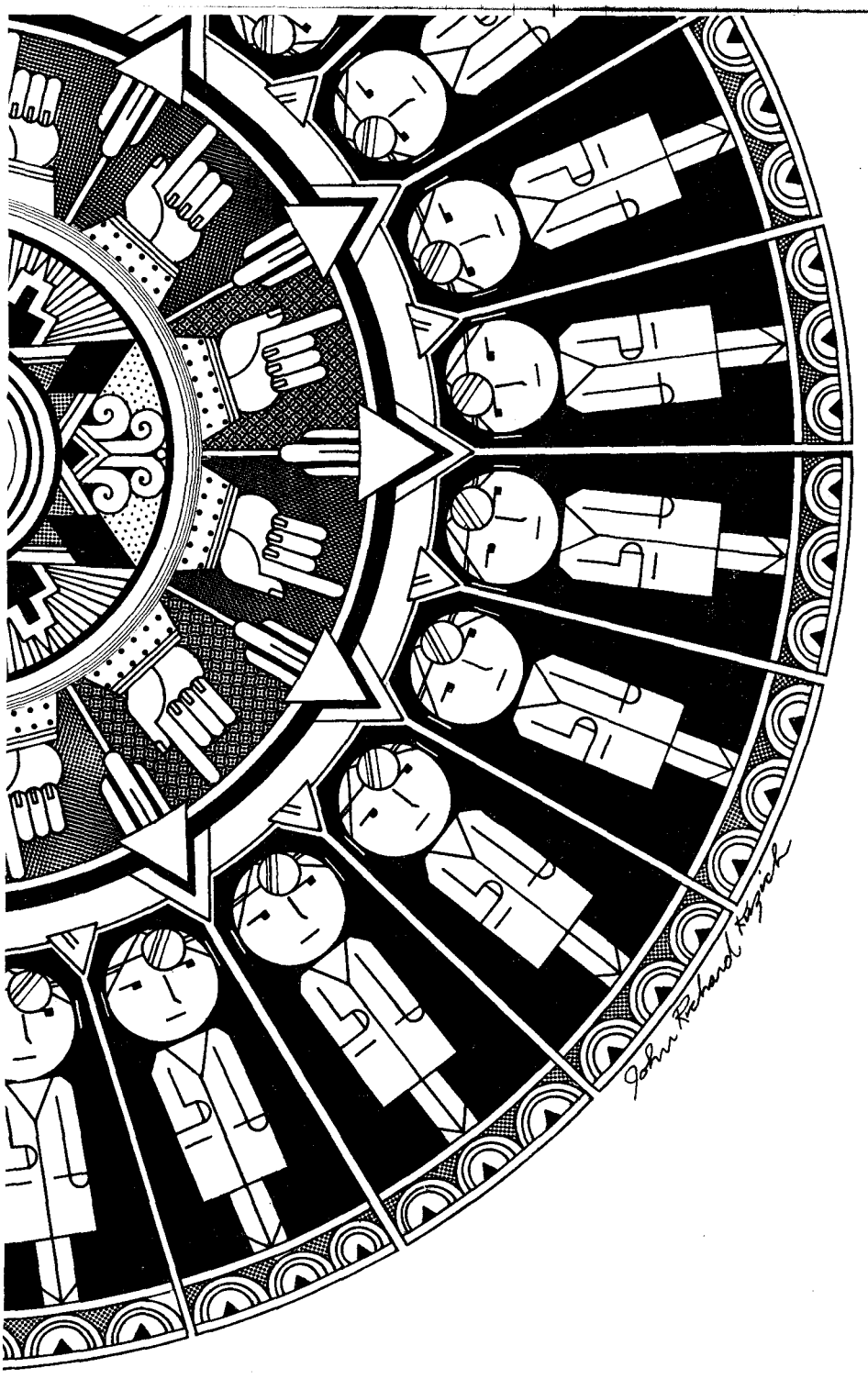

their training or standing. A physician friend of mine cites a recent case of a consumer-conscious prospective patient who believed that at least hints about a doctor's qualifications should be available. He believed that a prospective patient should not have to judge a physician's competence only by the outcome of treatment. During his initial visit to a physician to whom he had been referred, he asked the doctor where he had done his residency and if he were board certified. The indignant doctor asked the prospective patient to leave his office.

"Many people," says Franz J. Inglefinger, M.D., editor of the *New England Journal of Medicine*, "go to a given doctor, not because he owns good equipment or because he has an interest in preventive medicine, but because Aunt Mamie went to him and says he's wonderful." Most people, it seems, choose a doctor on the basis of incidental information and intuitive judgment, or by relying upon well-meant but medically uninformed sources of referral.

Yet such incidental, intuitive, medically vague considerations are not entirely illogical. Nor are they necessarily whimsical. They may, in fact, be the only means at hand for choosing a doctor. As every physician knows, and as many will admit, the medical profession itself does nothing to help anyone determine which physicians are better qualified than others. Once a physician has been admitted to practice, his peers will nevermore perform any evaluation of his competence that the public knows of, unless he engages in the most flagrant malpractices and is called to task by a local medical society—an event as rare as the sighting of an ivory-billed woodpecker.

There are some positive reasons for relying on the judgment and experiences of friends and relatives in deciding upon a doctor. It is important that the physician-patient relationship be one of trust, and trust is inevitably based on more than narrow professional competence. The conviction that a doctor cares can have a potent effect; testimony from friends and family that a doctor seems to know his business, is personally pleasant, and charges fees that are not out of line—this is not counsel without merit.

In any case, even if many people choose doctors on the basis of incomplete information—including cocktail party recommendations—that does not mean the public has no concern about physician practices or no thought about what makes "a good doctor." Although the choice of a physician is often limited by factors over which they have no control or by medical criteria that they cannot obtain or interpret, most people have a clear sense of priorities that ideally should be used in choosing a physician.

In recent surveys of public and physician opinion on health care, commissioned by Potomac Associates, a Washington-based research and analysis organization, the expectations and values of "citizen consumers" were compared with the attitudes of professional practitioners. One set of questions concerned the choice of a doctor. The results suggest some differences and some agreements, both of which can be important as the nation looks critically at its medical care system.

To the physician, the most important aspects of his professionalism are knowledge and capacity—knowledge based on his educational training and experience, and capacity including technical support and personal skill. Most physicians believe that a person is best advised to choose a doctor who has the background and ability to treat "the whole patient," who knows when to call in a specialist for assistance, and who is affiliated with a good hospital.

Despite differences in education, profession, age, and economic status that affect an individual's sense of priorities about choosing a doctor, most patients agree that a *good* general practitioner, who will use specialists when necessary, is the kind of doctor they want. But

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beyond that basic competence, most people feel that a highly important consideration in choosing a doctor is whether he will be available to attend to their health whenever the need arises. They want assurance that their doctor can be reached on short notice and, if necessary, that he will take care of them regardless of their ability to pay. Those for whom cost is not a problem obviously do not rank a doctor's willingness to treat a patient without a fee as one of the top four criteria in choosing a physician. Upper-income groups, having greater mobility than do the poor, rated a doctor's willingness to make house calls lowest among all considerations. Younger and well-educated people with high incomes were keener than other groups about their physicians' interest in preventive medicine.

There are also strong hints in the survey data that if people actually had a broader, practical choice in the matter—a circumstance that could occur as the national goal of additional numbers and better distribution of physicians is approximated—many of them would apply more exacting standards in selecting a doctor. Nevertheless, the present reliance on Aunt Mamie's recommendation is felt by many to be adequate.

In practice many people use both methods when they can, sometimes with results that seem unfair. A Maryland pediatrician tells, with some chagrin, the following story. A year and a half ago he responded to a frantic neighbor's midnight call. Her young son had a high fever and was in severe pain. The doctor she usually called upon had moved away. The boy's problem turned out to be a complicated stomach disorder, requiring emergency surgery, which the physician performed, and subsequent treatment in the doctor's office. Having learned that the woman was recently widowed and left with little money, the pediatrician sent no bill for the services he provided during the boy's illness and recovery. Recently he happened to see the woman and remarked that her son must be doing very well, since she had not brought him in for some months. "Not exactly," the woman replied. "Actually, he's had a couple of bad colds, but I took him to Dr. ———. A friend told me he charged two dollars less for an office visit than you do."

According to these surveys, most people recognize, encourage, and admire the professionalism of physicians. They believe that the difficulty in getting an office appointment is due to a shortage of doctors, which causes most of them to be overworked. They continue to approve federal support for medical research, and they want their doctors to keep abreast of new medical knowledge. A sizable portion of the public thinks it would be a good idea if, through periodic reexamination, physicians were systematically encouraged to keep up with the latest professional developments. Finally, the public manifests its continuing confidence in the medical profession by expressing more trust in organizations of doctors, such as the American Medical Association, than in any other group participating in the formulation of new federal health policies and programs. Nonetheless, the public is emphatic about what the purpose of this expert professionalism is: to serve the health needs of the people and to be available to provide medical care whenever it is needed. □

MOST IMPORTANT CRITERIA IN CHOOSING A FAMILY PHYSICIAN
(in percentages)*

Physicians	
Treats "whole patient," knows personal and family circumstances	67
Knows how to use a specialist	57
Affiliated with good hospital	39
Best possible education and training	39
Can treat most illnesses	31
Will treat patient regardless of ability to pay	25
Has good reputation in community	19
Stresses preventive medicine	14
Will make house calls	7
Has his own equipment	5
All other considerations	3
Not stated	1
Public	
Can treat most illnesses but also will call specialist when needed	53
Available on short notice	49
Will treat patient regardless of ability to pay	39
Aware of latest medical developments	36
Interested in preventive care	33
Has his own good equipment	27
Will make house calls	26
Knows patient's personal and family circumstances	22
Don't know	3
All other considerations	1

*Totals are greater than 100 because of multiple responses. Respondents were asked to identify only two or three items; the percentages here represent aggregation of all replies.

The survey of public opinion was conducted for the Gallup Organization, which polled a representative cross section of the U.S. population over 18 years of age. The survey of physician opinion, conducted by Erdos and Morgan, involved a stratified sample of 1,000 U.S. physicians.

A Shopper's Guide to Dentistry

From the state of Pennsylvania's Insurance Department comes a booklet containing some of the soundest advice published anywhere on finding a good dentist. This is the Insurance Department's seventh such consumer bulletin in a series that eventually will shed much needed light on many other professional organizations. (The department pioneered such handbooks on the governmental level in 1971 with a guide to Philadelphia hospitals.)

The "Shopper's Guide to Dentistry" begins with four pages of general warnings on such matters as blindly trusting the experts and finding a path through the dental jungle. But behind the rather homespun phrasing is hard-hitting and authoritative information. On trusting the "experts"—the sobering advice is, simply, don't. Eighty-one per cent of all dentists are in solo practice in private offices without anybody to check up on their performance, and what's more, dentists are prevented by their official code of ethics from criticizing the bad work of colleagues. On plunging into the dental jungle: use caution, because at least 15 per cent of the country's 118,175 (that's one in seven) dentists are either incompetent or dishonest or both. Each year, for example, six million teeth are extracted that should have been saved through other treatment.

The guide's strength lies in its list of 32 rules for selecting a dentist and for obtaining good dental care. A sampling:

- To find a dentist, check the faculty of a university's school of dentistry or ask your physician what dentist he uses. Consider dentists who practice in groups.
- Avoid dentists who cannot give emergency care, who discourage consultations, who don't discuss their fees, and who refuse to explain alternative treatments.
- The signs of good dental procedures include using a lead apron to protect patients while X rays are being taken and polishing fillings (it enhances durability as well as appearance).
- Even though any licensed dentist may practice as an orthodontist, periodontist, or other specialist, only 15 per cent of all dentists are certified in one or another of these fields. To find a specialist when needed, either ask your family dentist or write the American Dental Association at 211 East Chicago Avenue, Chicago, Illinois.

Except for the table of fees charged by Pennsylvania dentists included in the appendix, the guide is just as useful in Dubuque or Tampa as it is in Pittsburgh. Although free copies are available only to Pennsylvania residents, the dentistry guide may be purchased through Consumer Insurance in Washington, D.C. □

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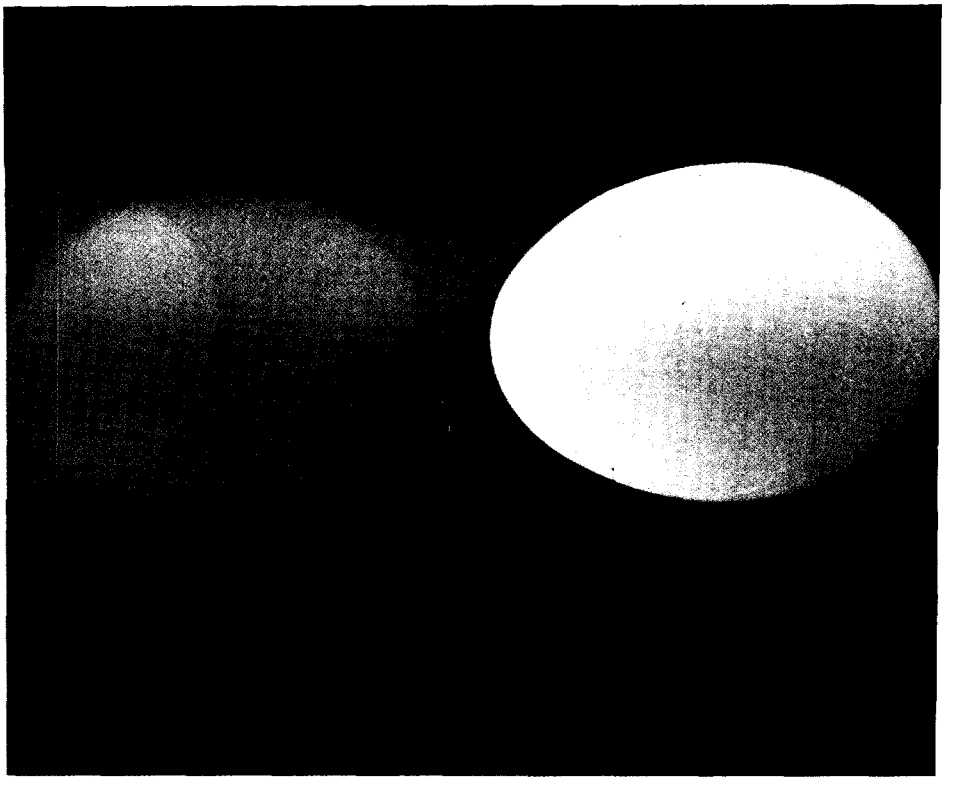
THE EGG & YOU

BY RALPH A. ERNST
Photographs by Peter Fronk



On its way from chicken to cake mix, today's egg travels through a mechanical wonderland. It is washed, inspected, sized, separated into yolk and white, dried or frozen, pasteurized and homogenized. Never is it touched by human hands.

The modern egg ranch is about as far removed from the traditional chicken coop as a 747 is from the horse and buggy. At the turn of the century, for example, the average farmer cared for a few dozen hens, and it often took up to two weeks to get their eggs to city markets. Today a single egg rancher can tend as many as 30,000 chickens, and there are egg ranches that house up to three million of the birds. The eggs from these hens generally reach supermarket shelves within 72 hours. This dramatic revolution in egg production is the result of painstaking research in many areas, including poultry physiology, nutrition, genetics, medicine, technology, and management.

Breeding the Modern Chicken

Only in recent times has the selective breeding of poultry been employed to improve egg production. For centuries chickens were bred primarily for their fighting ability—as fodder for the cock pit. Historically, poultry also were bred to develop striking or unusual plumage and other visual oddities. These aesthetic rather than practical experiments led to the establishment of poultry competitions or shows, events that are still popular today. It was not until around the turn of this century that scientists, working in the then newly developed land-grant colleges, began to apply the principles of genetics to the problem of producing more and better eggs.

Much of the success of these early poultry geneticists stemmed from a simple device known as the trapnest. Invented in the 1890s, it is basically a nest with a special gate at the entrance. When the hen enters, the gate closes, trapping her until she lays her egg. The breeder collects the egg, carefully marks it with the hen's identification number, and then releases her. This device, more than any technological advance, made large-scale pedigree breeding possible.

These early poultry geneticists quickly realized that the best chicken was not necessarily the one that laid the most eggs. The ultimate hen, they reasoned, should not only produce prodigiously but lay large eggs with sound shells and high interior quality. Furthermore, the hen should be resistant to disease and start laying at a young age. The geneticists of this era carefully studied how these desirable traits were inherited and how they were interrelated. By the 1950s it was evident that the Single Comb White Leghorn combined more of these desirable traits than did any other breed. Today it dominates egg production throughout the world.

The development of this super-hen revolutionized the egg industry. Superior chickens were bred and then widely publicized as they continually won random-sample egg-laying contests (in which hens are chosen from a flock at random). Unable to compete, many small breeders gradually dropped primary breeding efforts, often to become franchised hatcheries for larger breeding firms. By 1960 the breeding of egg-laying stock in America was concentrated in about a dozen large firms.

A Menu for the Henhouse

While some scientists were working to produce superior laying stock, others were looking for optimal ways to feed this stock. Perhaps the most significant advance in poultry nutrition occurred in the 1920s, when Vitamin D was discovered. With this vitamin added to the hen's diet, it became possible to raise her in confinement, without sunshine.

Gradually, nutrition research led to the discovery of a total of 13 vitamins and 13 inorganic elements known to be required by poultry for optimum growth and health. These nutrients can be expensive, however, and it was then necessary to determine the exact amount required daily by each age and class of

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poultry—no small task, since many of the nutrients interact in practical diets. In addition, protein and caloric-energy requirements had to be established.

By 1930, research revealed that proteins are broken down inside the chicken and absorbed in smaller chemical units called amino acids, and that these must be supplied in proper balance. Animal proteins such as meat or fish meal and milk products, although nearly ideal for poultry feed, are too expensive. With the introduction of soybeans into this country, however, a new, inexpensive feed ingredient became available—soybean meal. Although raw soybean cake contains some deleterious elements—e.g., proteins known as trypsin inhibitors that interfere with digestion—these are destroyed by heating. The poultry industry throughout the world now relies on soybean meal for the bulk of its protein.

The search for an economical source of caloric energy still continues. At the moment, poultry calorie requirements are met by cereal grains, such as corn, milo, and wheat. However, current research into high-yielding grain varieties holds promise of more economical feeds in the future.

On a day-by-day basis, the food requirements of poultry vary considerably, depending upon such things as the weather, the age of the birds, and egg-production rate. Since economy is the byword of egg ranching, any nutrient supplied beyond the basic needs of the flock is considered wasted. Thus, the challenge of the nutritionist is to design diets that exactly meet the needs of a particular flock. To meet this challenge, poultry scientists have enlisted the computer, which in minutes can examine every possible combination of ingredients, selecting the most economical.

The Chicken Doctors

Since poultry was first domesticated, disease has been a constant problem. Serious diseases surfaced when chickens were first confined, and it became evident that it was unwise to keep more than a small flock on any one farm. Not that a smaller flock reduced the occurrence of disease; it only minimized overall losses.

Since then scientists have learned a great deal about the causes and transmission of the most important poultry diseases. Several methods of control are now available, including vaccination, preventive and therapeutic drugs, and the development through blood testing of disease-free stock. One of the early success stories was the control of pullorum disease, a highly fatal bacterial infection that attacks young chicks. Survivors of this malady appear normal but retain the infection in their reproductive systems and transmit it to their offspring through their eggs. When a blood test was developed to detect carriers, clean breeding stock was established, and the federal government began certifying hatcheries that were pullorum-free.

Pharmacologists have developed a number of drugs useful in the treatment or prevention of various poultry diseases. For example, chickens are susceptible to infection by two types of protozoa that can be combatted by continuous feeding of drugs in small amounts. Of course, the discovery of antibiotics also had a dramatic impact on disease control in poultry, particularly for respiratory diseases and bacterial infections.

The most dramatic breakthrough, however, was the control of Marek's disease through vaccination. Marek's, a cancerous disease with a high fatality rate, had long baffled poultry scientists and caused serious losses. In 1969 the causative agent, a herpes virus, was isolated, and later a successful vaccine was developed from a similar virus of low virulence. This is the first successful vaccine for a cancerous disease in man or animals. It provides a ray of hope that control of similar diseases in man may also be possible.

Inside the Henhouse

Modern chickens never see the light of day. Their parents—"breeder" stock—are kept in a special house, usually with one rooster for every 12 hens. From there the fertilized eggs are transferred to a hatchery, where, the day after the chicks hatch, they are "sexed"—the males separated from the females. The rule here is simple: if it doesn't lay, it doesn't pay.

The sexer, if he or she is an expert, can separate several thousand chicks a day with high accuracy, but sexing is an art that takes years to develop. Originally, sexers made their distinctions by examining the chick's vent (its genitalia). Now, however, poultry geneticists are developing strains that can be sexed according to feather patterns on the chick's wings.

After separation the female chick is sent to a "brooder" house, where she is kept warm until her feathers grow. She is also debeaked; half of her top beak is cut back to prevent her from injuring her cage mates. At about 20 weeks the female is moved again, this time to the "lay" house, where she soon starts producing eggs at a rate of about 240 eggs per year. A hen's productive life ends at about 25 months, when her laying capability drops off. At this point she is shipped out, most likely to end up in a soup can.

The hen spends her productive life in a windowless building with her feed delivered several times daily by conveyor belt; her eggs roll off the slanted cage bottom onto another small conveyor, from which they are mechanically collected.

Because of diets fortified with Vitamin D, chickens can be raised in enclosed houses. Sunlight, however, is important in other ways. For example, farmers long have known that a hen lays more eggs in the spring than in any other season. Chickens, like most animals, have biological clocks pegged to the duration and intensity of light. Length-

Some Egg Questions Other Than "Which Came First . . . "

1 Brown eggs are more nutritious than white eggs.
True☐ False☐

2 The color of an egg's yolk is related to its nutritive value.
True☐ False☐

3 Eggs with runny whites are old.
True☐ False☐

4 Fertile eggs are more nutritious and lower in cholesterol than unfertilized eggs.
True☐ False☐

5 Discolored yolks in hard-boiled eggs are caused by sulfur and iron compounds in the eggs.
True☐ False☐

6 Fresh eggs are difficult to peel when they are hard-boiled.
True☐ False☐

7 Blood spots in eggs indicate spoilage and thus that eggs are unsafe to eat.
True☐ False☐

8 The sugar added to egg whites in commercial meringue toppings prevents bacteria from growing.
True☐ False☐

9 You can distinguish hard-boiled eggs from uncooked ones by spinning them.
True☐ False☐

10 The stringy, white pieces in raw egg whites indicate spoilage.
True☐ False☐

The answers to this quiz are given on page 43.

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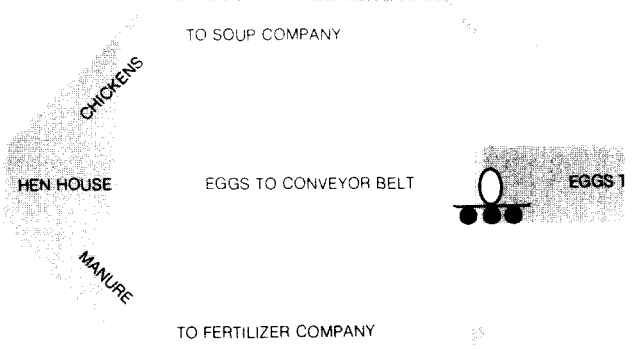

Rancher in a sea of chickens (below); a debeaked hen (bottom). At right, eggs flow from small to large conveyor.

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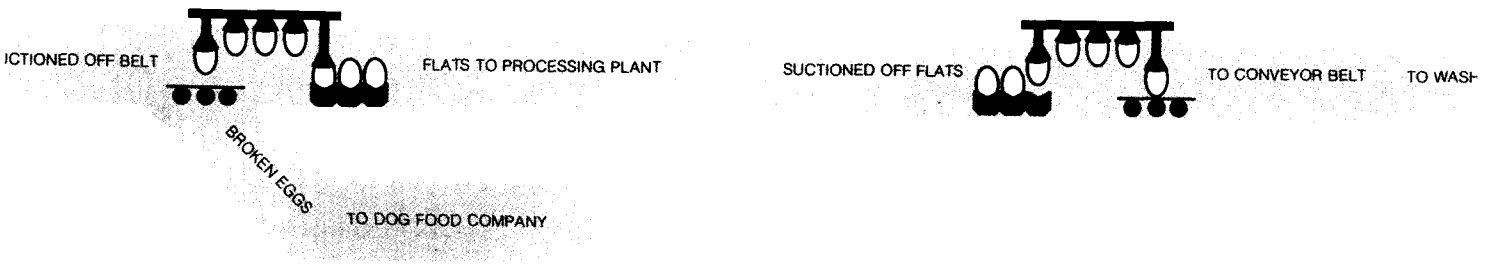
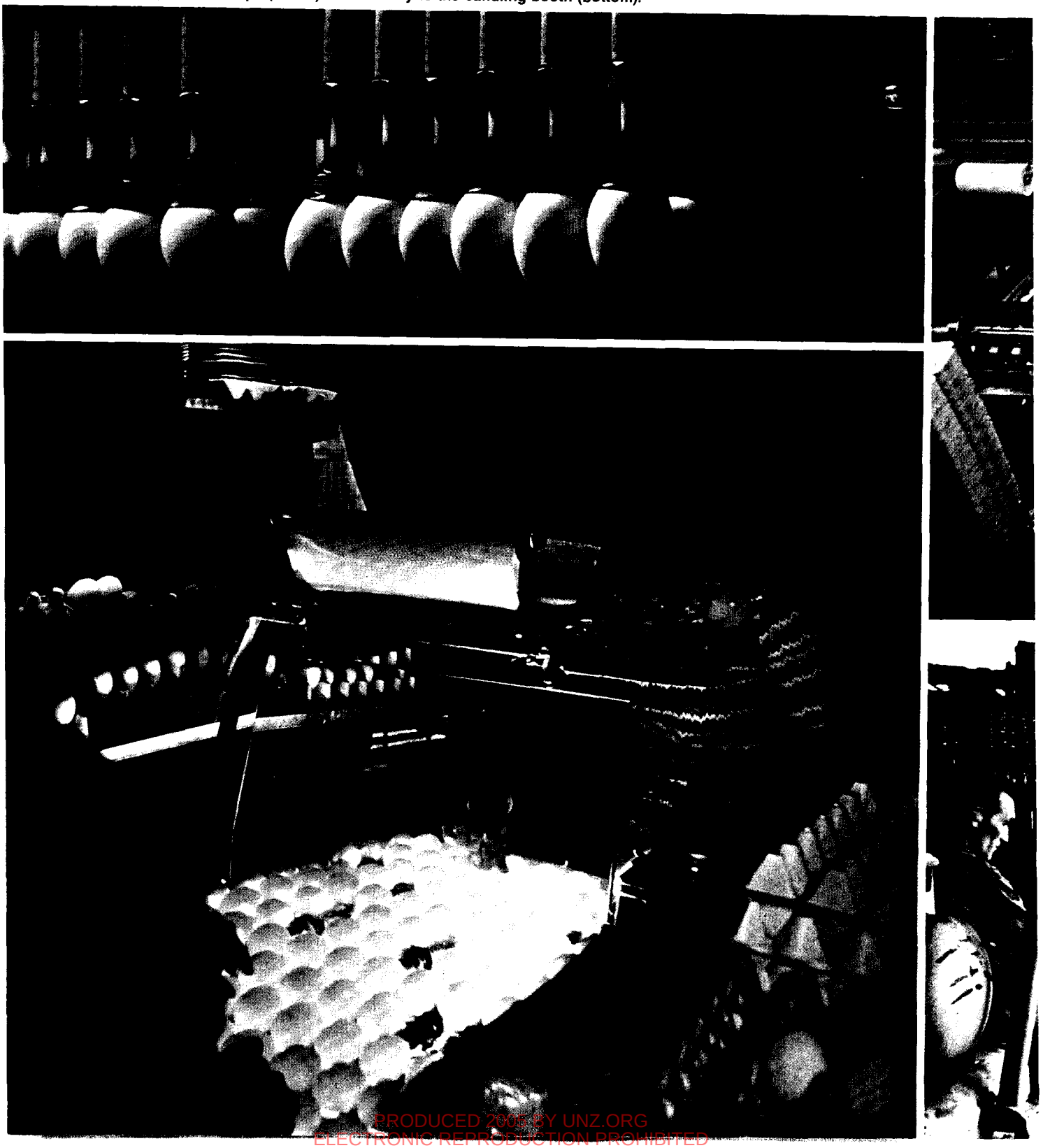


Eggs are held by suction cups (below) on their way to the candling booth (bottom).



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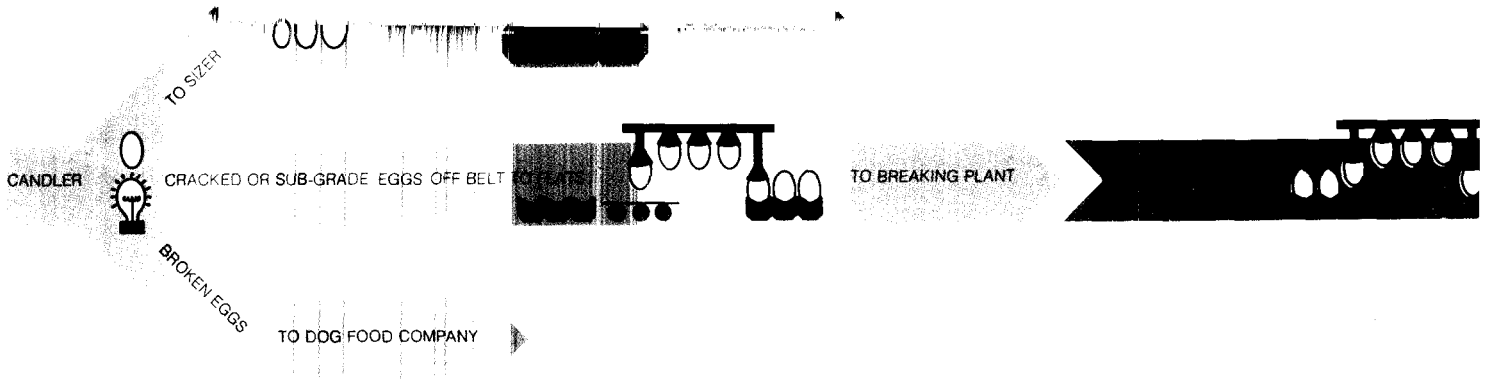
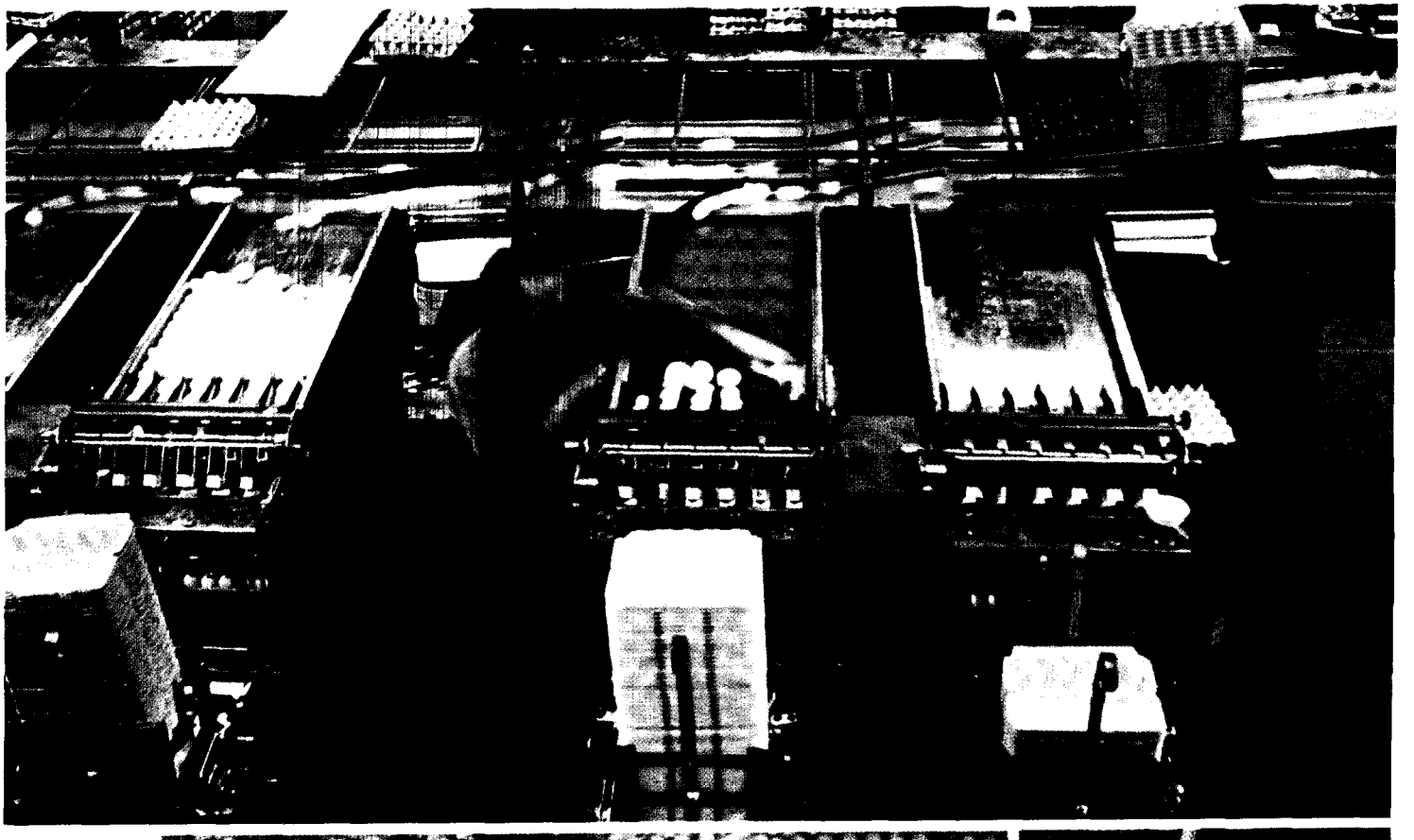
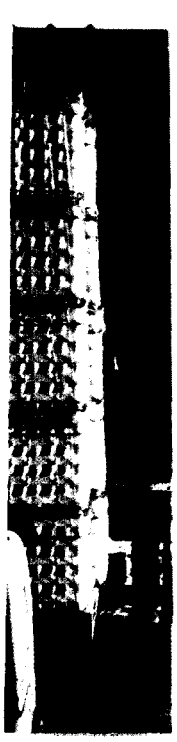
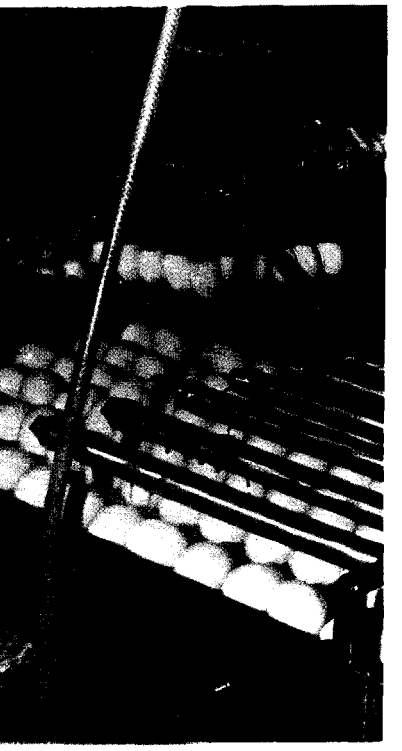


Egg sizing and cartoning (below). Bottom: eggs ready for market (left); eggs in flats (center); below-grade eggs in washer (right).







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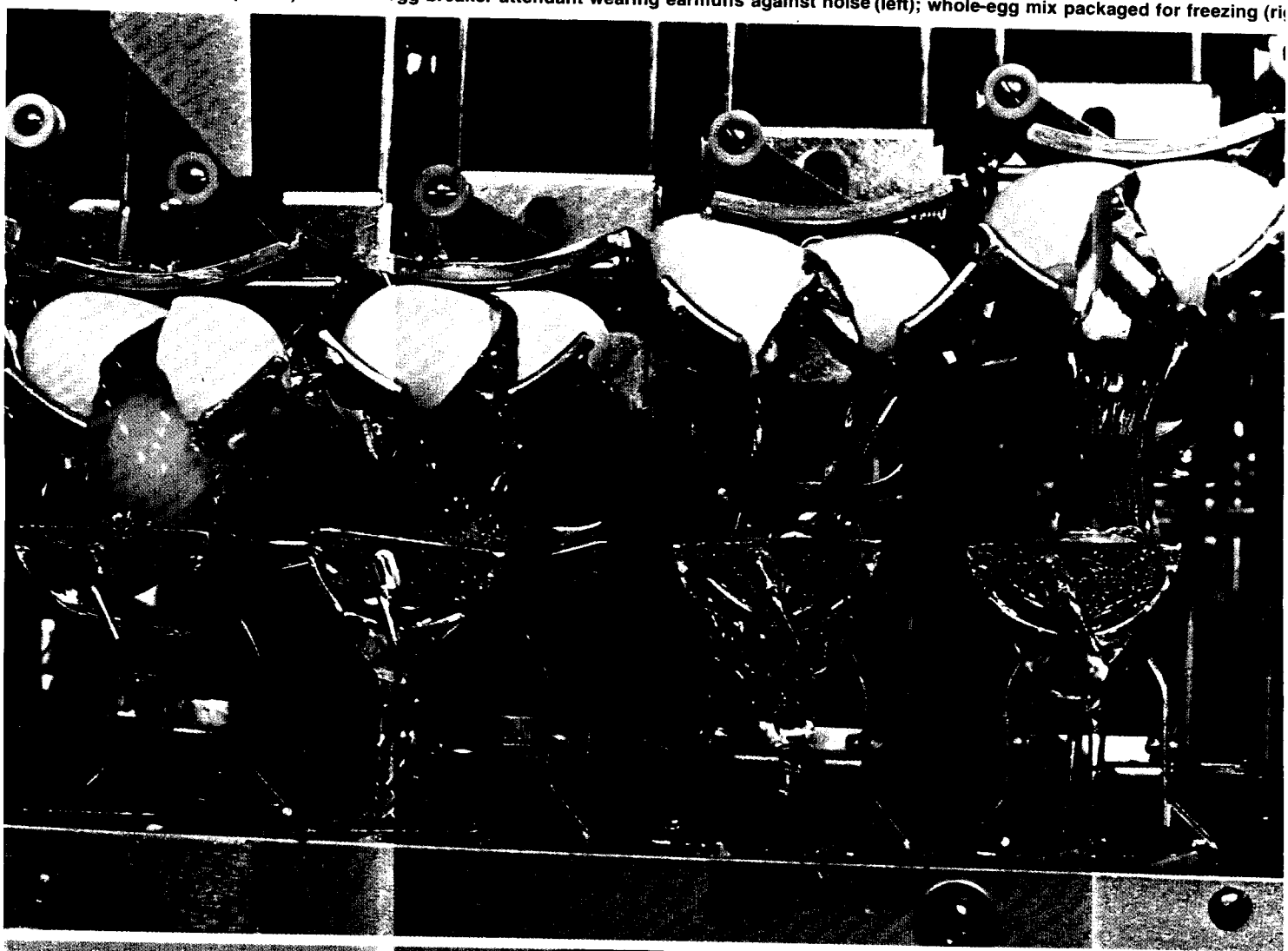
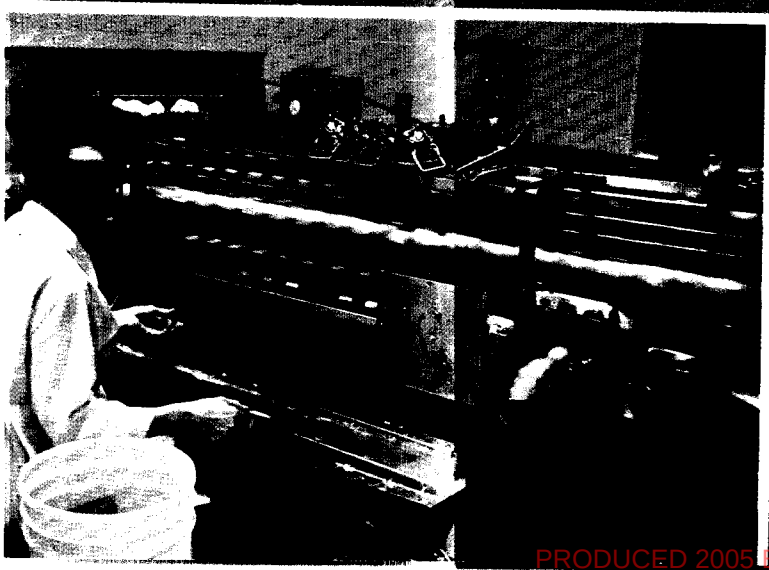
The egg breaker at work (below). Bottom: egg breaker attendant wearing earmuffs against noise (left); whole-egg mix packaged for freezing (ri





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ening days signal spring; decreasing sunlight, fall. In the modern henhouse these patterns are easily mimicked.

Maturing pullets, for example, are exposed to "short days"—lights are left on for only eight hours—to prevent them from laying until they have reached ideal body size. Without this control, pullets hatched in the fall or winter would begin laying too soon. (If the pullet's body and oviduct are incompletely developed, she may have difficulty in laying and chance permanent injury or even death.) When the pullets reach optimum age and size, the lights are left on for 16 hours a day. Two weeks later they begin laying eggs, reaching peak production in about ten weeks.

Enclosed housing has another advantage: temperature can be regulated. Although chickens can tolerate a great range of temperatures, they are "comfortable" between 55° F and 75° F. Since they have no sweat glands, above this limit hens must cool themselves by panting (evaporating water from their lungs). Thus modern henhouses in warm climates are either air conditioned or contain automatic fogging devices to wet and thereby cool the hens.

Below 55° F, hens, like humans, keep warm by increasing their body heat, a practice that burns a lot of calories. If additional calories are not supplied through increased feed, the hen uses what she has to keep warm rather than to lay eggs. This is the reason egg prices tend to be highest during the winter months, although with the increased use of temperature-controlled housing, this trend will probably disappear.

From Henhouse to Market

In bygone days getting eggs from ranch to consumer was a long, arduous process. The farmer collected them by hand, and then, usually once a week, they were picked up by an assembler who, when he had a full truck or rail car, would ship them to a terminal in a city market. Once there, the eggs were resold, reprocessed, repackaged, and distributed to stores. When they finally reached the consumer, the eggs were often a month old. Sometimes, when eggs were plentiful, they even were put in cold storage for several months before processing.

Today eggs are processed in plants on or near the ranch, generally the day after they are laid. Almost invariably, they get to the store within 72 hours. Whole eggs are never stored for more than a few days before being sold.

This change is due to the marvels of engineering and applied science that comprise a modern shell-egg or whole-egg processing plant. The eggs are collected on conveyors; at the end of this belt, the eggs are picked up by a suction device, transferred to flats (30 per flat), and put in cold storage (55° F). The next day all the flats are moved to the starting end of the processing line, where they are picked up by a suction device, a flat at a time, and deposited back onto a conveyor. They are washed, then dried by a warm-air blower, sprayed with mineral oil to seal their shells, and moved into a candling booth. In the booth the eggs are illuminated from below while an employee inspects them, removing from the line all eggs with cracked or defective shells, blood spots, or other defects. After inspection the belt delivers the eggs to a machine that separates them by weight (jumbo, large, medium, etc.), and each size is diverted into a packing area, where the eggs are mechanically placed in cartons (supermarkets often supply the processing plants with their own cartons). The cartons are then hand packed in racks or cases for delivery to stores.

Egg processing is supervised by government inspectors and must meet state and federal standards. In general, only Grade AA or A eggs are sold in stores. The grading is according to shape, shell smoothness, and interior quality. This last is judged by air-cell size and yolk shadow. Over time, eggs release water and carbon dioxide through their shells, which increases the air-cell size and makes the whites runny. As a double check, sample eggs are broken to measure how thick the whites are. Most under-grade eggs are sent to an egg-breaking plant for use in frozen or dried egg products. (This includes cracked eggs, as it is now illegal to sell them by grade in stores.)

The egg-breaking plant is a separate operation, and the breaking is done under continuous U.S. Department of Agriculture inspection. The eggs are trucked from the processing plant to the egg-breaking plant, where they are washed again, and proceed to the most incredible machine of all—the egg breaker. This machine, capable of handling more than 270 eggs per minute, cracks open the eggs and separates the yolks from the whites.

From the egg breaker, whites, yolks, and whole-egg mix disappear into tubes to be homogenized and pasteurized. The end products are then shipped out as liquids (in tanker-trucks), frozen (in 30-pound containers), or dried (in 50-pound cartons). These go to such places as bakeries, cake-mix and mayonnaise companies, noodle manufacturers, and institutional cafeterias. Eggs found unfit for human consumption are sold to pet food manufacturers.

Modern egg ranching, then, is a highly integrated, extremely efficient business—for good reason. Unlike most products, the consumption of eggs in this country is almost static. People continue to eat two eggs for breakfast whether eggs are 35 cents per dozen or 70 cents per dozen. But they *will* buy the cheapest available eggs. As a result, competition in the egg market is cutthroat, and profits (if any) are a result of *economy* at the production end. In California, for example, egg ranchers have been operating at a loss for the past two years because of an oversupply of eggs selling at extremely low prices.

Consequently, the search continues for more economical feeds, more productive chickens, and any new idea to cut the rancher's costs. Hy-Line Poultry Farms, for example, has just started marketing a new breed or chicken: dwarf leghorns. Two normal leghorns consume 160 pounds of feed and lay 480 eggs per year. Three dwarfs, two-thirds the size of normal ones, consume the same amount of feed but lay a total of 600 eggs, which are, on the average, only slightly smaller in size.

What next? □

ANSWERS TO EGG QUIZ

1 False. Shell color does not affect nutritive value.

2 False. Yolk color is determined by the amount of vegetable pigment in a hen's diet and has no effect on nutritive value.

3 True. Eggs release carbon dioxide through their shells, which, over time, causes the whites to break down.

4 False. There is no evidence of difference in nutritive value between the two.

5 True. To avoid discoloration, put eggs in cold water, bring them to a boil, turn off the heat, cover pan, let stand for 15 minutes, and then cool them in cold running water.

6 True. For easier peeling, refrigerate fresh eggs for four days before cooking.

7 False. Blood spots are from small hemorrhages in the hen's reproductive tract and are perfectly safe to eat.

8 True. Commercial egg whites are also pasteurized.

9 True. A raw egg simply will not spin.

10 False. They are strands of thick albumin that form when an egg has been rotated and are completely normal structures.

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On his seventh birthday our author was given a Monopoly set. Twenty years and one Ph.D. later, he passed it on to a computer.

How to Win at MONOPOLY

BY IRVIN R. HENTZEL

Ironically, it was the Depression that led a heating engineer by the name of Charles Darrow to jot down the street names of Atlantic City, his favorite resort, on a piece of kitchen linoleum. In 1933 Darrow, unemployed as an engineer since the stock market crash of 1929, was expecting his second child. Hard put to feed his family, he took such odd jobs as walking dogs, fixing electric irons, and patching concrete. In his ample spare time, to keep his mind off his troubles, he invented things. What he invented on that piece of linoleum was Monopoly, the largest-selling game in the world.

Darrow took his invention to Parker Brothers, the celebrated games manufacturer in Salem, Massachusetts, but was turned down. Parker Brothers claimed the game violated just about every rule for what a successful game should be—it took too long to play, the rules were too complicated, it involved confusing concepts (such as mortgage and interest). Undaunted, Darrow continued to produce the game by hand until its popularity soared to such heights that, in 1935, Parker Brothers changed its mind. Darrow quickly became a millionaire gentleman farmer, world traveler, and collector of exotic orchid species.

Darrow's invention is different from most popular games in that there is virtually no way in which a player can control his moves. He simply rolls the dice and moves the required number of spaces. If he lands on a Chance or Community Chest square, he picks a card and follows its directions. However, Monopoly does involve some extremely complex decisions. The successful player is one who skillfully buys property and invests in houses and hotels so that he acquires the bulk of the money and drives the rest of the players to bankruptcy. This means that he must put his money where it will bring the best return. But in Monopoly —as in the real world of high finance —the choice is not always as obvious as it appears.

The Monopoly player's most common mistake is to equate the return from a property with its rent. For example, many players believe that the Boardwalk–Park Place monopoly is the best one to own, because the properties have the highest rentals in the game: $1,500 for a hotel on Park Place; $2,000 for a hotel on Boardwalk. However, there are only two properties in this monopoly; thus players will land on it less frequently than they would on a monopoly with three properties.

Of course, one could compute the value of a monopoly by adding the rents of each of its squares. In this case, the green monopoly (Pacific Avenue, North Carolina Avenue, and Pennsylvania Avenue) yields the best return—$3,900 with a hotel on each property. However, the green monopoly lies on the far side of the Go to Jail square; green's landlord will probably lose some of his tenants to the authorities. In addition, there are no Community Chest or Chance cards directing a player to any of the green properties, while there is a Chance card ordering players to "take a walk on the Boardwalk." Clearly, then, the expected return from a property depends not only on its rent but on the frequency with which players land on it.

Calculating the probability of landing on a specific property is a complicated matter. Adjustments must be made for the possibility of throwing doubles (in which case the player moves again), for landing in jail, for instructions from Chance and Community Chest. However, the job is not too complicated for a computer.

A chart describing a computer program for calculating the probabilities of landing on a particular square on the Monopoly board is given on page 45. This program was sent through a computer 180 times to simulate 180 turns. (One, two, or three rolls of the dice constitute a turn; a player's turn is over when he hands the dice over to his opponent.) The probabilities, it was found, stabilized to 15 decimal places after 140 turns. For practical purposes, the probabilities were the same after 25 turns, and, as any battle-scarred veteran of Monopoly knows, 25 turns is hardly even a call to arms.

The probabilities that resulted from the computer calculations are displayed in the table on page 46. The square most frequently landed on is Illinois Avenue, followed by Go, B.&O. Railroad, Free Parking, Tennessee Avenue, New York Avenue, Reading Railroad, St. James Place, Water Works, and the Pennsylvania Railroad.

The expected return for each property now can be determined by simply multiplying the probability of landing on the property by its rent with houses or a

Irvin R. Hentzel is an assistant professor of mathematics at Iowa State University.

Technical drawings by the author and Louis Neiheisel. Monopoly graphics ©by Parker Brothers Inc.

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hotel. This figure is the average amount a player can expect to collect each turn if he owns a property in a certain state of improvement. The expected return of a monopoly is the sum of the expected returns of the properties. With hotels the expected return for the various monopolies increases in the order that the monopolies occur on the board. There is one exception: the Boardwalk–Park Place monopoly, in terms of expected return, ranks above the orange monopoly and below the red.

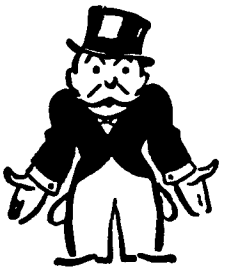
Although the expected return for each monopoly, calculated in this fashion, is a helpful figure, it is by no means the final consideration for playing the game. Owning the monopoly with the highest return per turn (the green) will not always make you a winner, nor will owning the purple monopoly (the lowest return per turn) make you a loser. A more crucial standard is the expected return per dollar invested.

The property that produces the highest rentals does not necessarily offer the greatest return per dollar invested, because the cost of improvement—putting up houses and hotels—is not the same for each property. To calculate the return per dollar invested, divide the cost of a particular improvement by the rent you can expect for that improvement. On the average, the orange monopoly yields 4.5 cents per dollar spent on initial purchase and improvements. In contrast, the green monopoly, which has the highest expected return in the game, yields only 2.8 cents per dollar invested. Most of the other monopolies lie somewhere between these two, returning an average of 3.5 cents per dollar invested. However, whether you evaluate properties by expected return or expected return per dollar invested, the Utilities monopoly is by far the worst to own.

Which monopoly is best therefore depends on the amount of money you have to invest. From the graph of Expected Returns per Dollar Invested on page 47, it is clear that the properties with the highest rentals are less valuable than lower-income properties when only small sums are available for improvements. Below $500, railroads yield the greatest return per dollar invested. From $800 to $2,000, the orange monopoly is superior. Only after $2,500 has been invested does the green monopoly take the lead.

Peasants and Tycoons

With the computer's calculations at your side, you are now ready to begin investing. The first thing you must do is estimate how much money you and your opponents will be able to raise over the course of the game. This estimate provides the basis for choosing a strategy for playing.



The Computer Program

The computer program described in the flow chart below was used to compute the various probabilities necessary for a mathematical analysis of Monopoly. The initial step in the program involves the determination of an "assigned probability"—the probability that a player will be on a particular square at the beginning of his turn. There are 40 squares a player can occupy, and, for calculation purposes, these are numbered in the direction of play. There are also three stages of being in jail.

There is another adjustment to be made, however, before the computer can consider the first roll of the dice. This is to cover the possibility that a player begins his turn in jail, and gets out during that turn. He may do so by paying a $50 fine to the bank or by throwing doubles.

If a player pays the fine, he will move to Just Visiting before throwing the dice. To account for this possibility, we add the assigned probability that a player began the turn in jail to the assigned probability of Just Visiting. If a player in jail elects not to pay, he has a one in six chance of throwing doubles and escaping. This probability is spread among the six squares on which he could land if he did throw doubles. The probabilities for landing on squares 12, 14, 16, 18, 20, and 22 are each increased.

The First Throw: Armed with these adjusted probabilities, the computer is now ready to consider the first throw of the dice. There are two possibilities at this point—the player either throws doubles or he does not. In either case, adjustments must be made for Chance and Community Chest.

If a player lands on a Chance or Community Chest square, he must draw a card and follow its instructions. Some of these instructions require a player to move from the square on which he has landed. For example, two of the 16 Community Chest cards send players to other squares. The probability that a player will land on the Go or Jail square is thus increased by the probability that he lands on any one of the Community Chest squares and draws the appropriate card. At the same time, the probability of remaining on the Community Chest square is decreased.

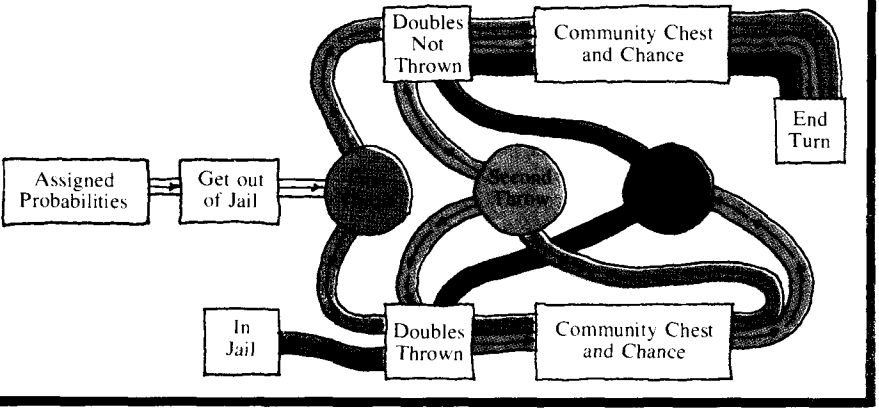
An additional adjustment is built into the program for the "Go to Jail" square. Obviously, a player landing on this square does not remain there; he goes directly to jail. To account for this, the probability of ending a move on this square is set at zero, and the probability of being sent to jail is increased by the probability of landing on "Go to Jail."

The Second Throw: If a player has rolled doubles, he gets to throw the dice again. The probabilities just calculated for the first throw are now the probabilities for where a player will be at the start of his second roll.

The operations performed by the computer for the second throw are the same as for the first. The probabilities for doubles thrown and doubles not thrown are computed, and adjustments are made for Chance and Community Chest.

The Third Throw: If a player throws doubles on his second roll, he is allowed one more try. If he throws doubles again, he goes directly to jail. Thus the probability of ending a turn in jail is increased by the probability of throwing doubles on the third roll. If doubles are not thrown, the computer uses the probabilities resulting from the last roll to calculate where the player may land on this throw and adjusts for Chance and Community Chest. No matter what happens on the third throw, the turn ends.

The probability that a player has *landed* on a particular square during the course of his turn is therefore the sum of the two probabilities from the first throw (doubles thrown, doubles not thrown), the two probabilities from the second throw (doubles thrown, doubles not thrown), and the probability for doubles not thrown from the third turn. On the other hand, the probability that a player will *end* his turn on a particular square is the sum of the probabilities for doubles not thrown in each of the three throws.



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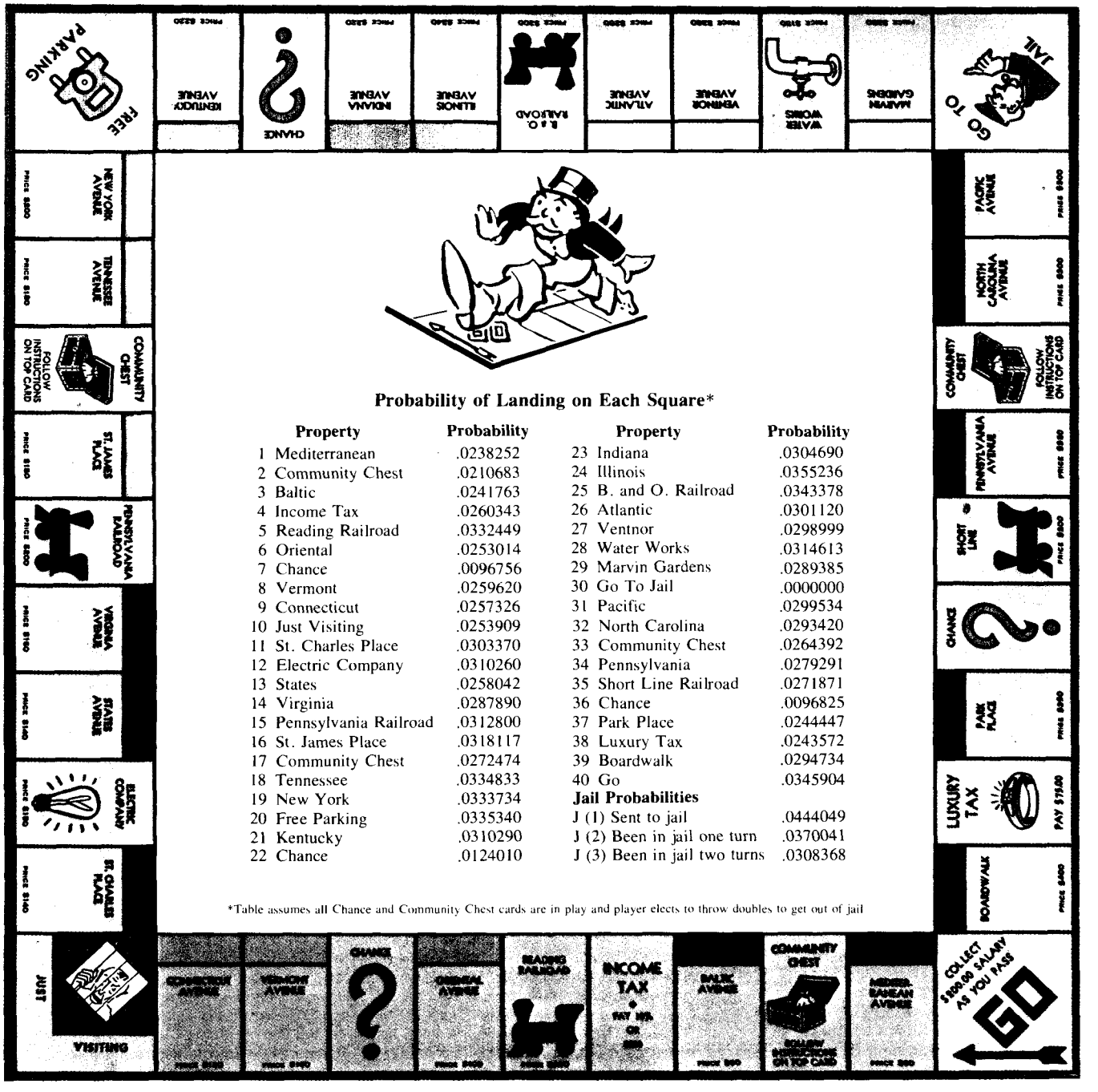

Probability of Landing on Each Square*

Property	Probability	Property	Probability
1 Mediterranean	.0238252	23 Indiana	.0304690
2 Community Chest	.0210683	24 Illinois	.0355236
3 Baltic	.0241763	25 B. and O. Railroad	.0343378
4 Income Tax	.0260343	26 Atlantic	.0301120
5 Reading Railroad	.0332449	27 Ventnor	.0298999
6 Oriental	.0253014	28 Water Works	.0314613
7 Chance	.0096756	29 Marvin Gardens	.0289385
8 Vermont	.0259620	30 Go To Jail	.0000000
9 Connecticut	.0257326	31 Pacific	.0299534
10 Just Visiting	.0253909	32 North Carolina	.0293420
11 St. Charles Place	.0303370	33 Community Chest	.0264392
12 Electric Company	.0310260	34 Pennsylvania	.0279291
13 States	.0258042	35 Short Line Railroad	.0271871
14 Virginia	.0287890	36 Chance	.0096825
15 Pennsylvania Railroad	.0312800	37 Park Place	.0244447
16 St. James Place	.0318117	38 Luxury Tax	.0243572
17 Community Chest	.0272474	39 Boardwalk	.0294734
18 Tennessee	.0334833	40 Go	.0345904
19 New York	.0333734	**Jail Probabilities**	
20 Free Parking	.0335340	J (1) Sent to jail	.0444049
21 Kentucky	.0310290	J (2) Been in jail one turn	.0370041
22 Chance	.0124010	J (3) Been in jail two turns	.0308368

*Table assumes all Chance and Community Chest cards are in play and player elects to throw doubles to get out of jail

If you feel that you will not be able to accumulate enough money to make one of the more expensive properties pay off substantially, you should opt for the Peasant Strategy: that is, choose a monopoly that pays off well in the beginning of the game (consult graph on page 47) when small sums of money are available, and at the same time try to prevent your opponent from acquiring enough capital to improve his own property. If, however, you think you can raise a good deal of capital—at least $2,000—you might employ the Tycoon Strategy and invest in a property with an expected return higher than your opponent's, even if that return comes late in the game. Obviously, the best choice for the Tycoon Strategy is the green monopoly.

Peasant Strategy could be played with any property whose expected income from rent (with hotels) is lower than your opponent's; but it is best to play with a monopoly whose early returns are very high. From the graph it is apparent that the orange monopoly is the perfect property for Peasant Strategy, because it yields the highest return when $800 to $2,000 is available for investing. Boardwalk also is a good choice for the Peasant game. Remember that your aim in Peasant Strategy is to acquire money quickly so that you may build early in the game, while your profits are still higher than your opponent's; at the same time you must keep him too poor to improve his property to the point at which it becomes more profitable than your own.

Trading properties is a good way to accumulate money for the Peasant Strategy and thwart your opponent at the same time; therefore, even if you already own the monopoly you want, you should do a little trading. If your opponent is loaded—perhaps he has saved most of the $1,500 he began the game with—try to sell him property for money. For example, trade him the green monopoly for the light blue and $1,000. To the unmathematical Monop-

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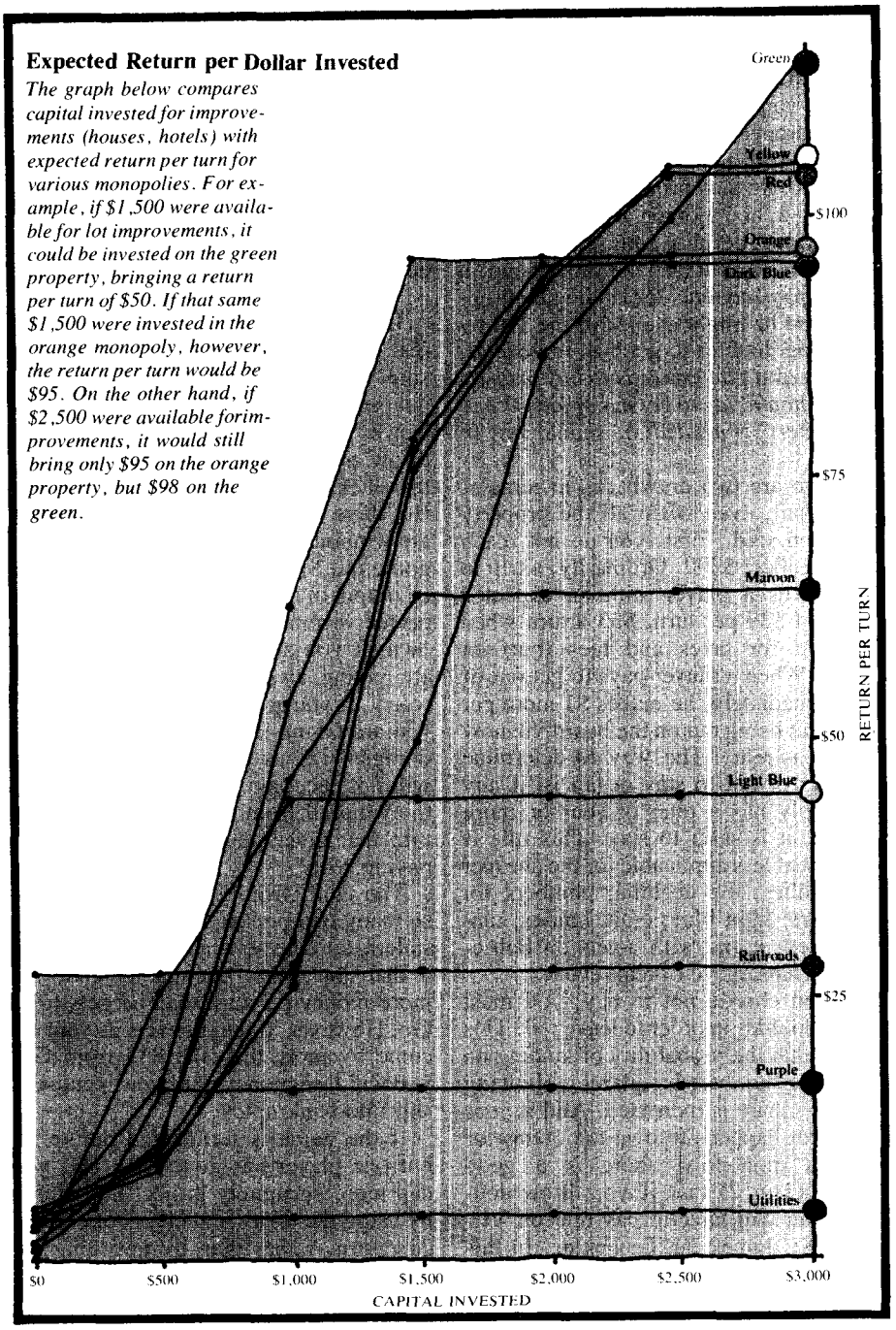
Expected Return per Dollar Invested

The graph below compares capital invested for improvements (houses, hotels) with expected return per turn for various monopolies. For example, if $1,500 were available for lot improvements, it could be invested on the green property, bringing a return per turn of $50. If that same $1,500 were invested in the orange monopoly, however, the return per turn would be $95. On the other hand, if $2,500 were available for improvements, it would still bring only $95 on the orange property, but $98 on the green.



oly player, this appears to be a grave error on your part: you have given away the "best" property in the game. In reality, the deal is much better for you. Your opponent gains the green monopoly but loses $1,000 of the capital he would need to make it pay off. At the same time he has an additional monopoly, on which he will be tempted to build, when in fact it is more profitable for a player to concentrate his building efforts on one monopoly at a time. You, in the meantime, have acquired $1,000 in cash and property that you can mortgage for additional capital, all to build up your Peasant monopoly.

Another Peasant barter that is extremely profitable early in the game is to trade a monopoly for the railroads. When your opponent has tired of paying you $200 every time he lands on one of the four railroads—and the probability of landing on a railroad is high—he will be willing to trade for them with one of his monopolies, probably a cheap one, such as the maroon properties (St. Charles Place, States Avenue, and Virginia Avenue). By this time, however, you will have saved enough money from railroad rents to improve this monopoly quickly; you will then make more money in rents than you will have to pay to your opponent for landing on his railroads.

In addition to trading, you can raise money quickly by selling properties to other players, mortgaging property to the bank, and selling "Get out of jail free" cards. No matter how you acquire it, immediately put your capital into houses on your Peasant monopoly. Of course, this is risky; you may have to sell them back to pay rents or taxes. But in a Peasant game, your chance to win is now. By building early in the game, when your property yields a higher return than your opponent's, you will continue to receive more money in rent than you will have to pay out. Furthermore, by paying high rents to you, your opponent will not be able to raise the money to improve his own property. However, if you wait until it is safe to buy houses, your opponent will have saved enough money to make his property pay off better than yours.

On the other hand, if you choose the Tycoon Strategy, do not build until you have acquired enough capital to make your property more profitable than your opponent's. As shown on the graph, this is the point at which the line of your monopolies crosses your opponent's. The only way you can reach this point is to discourage your opponent from building on his property; his early returns are higher than yours, and drain on your cash reserve will prevent you from improving your property.

Tycoon tactics, in large part, are psychological. Talk as if cash in hand is the most important point in the game. Emphasize that the game is too fresh for building. Even if your opponent should build a house or two, do not reciprocate. You also might avoid trading property to acquire a Tycoon monopoly until you have raised enough money to build on it. This works especially well if your opponent has a property you need and you have one he wants. For example, suppose that near the beginning of the game you have Boardwalk and your opponent has Park Place. He also has two of the green properties, but you have the third. Ordinarily, you might try to trade the green property for Park Place and, in so doing, acquire a good monopoly for a Peasant Strategy. More likely, your opponent would refuse to make such a trade, believing, as many players do, that the Boardwalk–Park Place monopoly is the best on the board. In that case, simply move your marker around the board for 100 turns or so, and then say, "This is silly; we're getting nowhere. You can have Boardwalk–Park Place if you give me the green ones." During those 100 turns you will have accumulated a hefty bankroll from passing Go without having to pay rent on improved lots. Invest this promptly in hotels on your newly acquired green monopoly, and you will win, as a Tycoon.

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The Finer Points

A mathematical analysis of Monopoly provides some additional clues for winning the game, no matter which strategy you choose. Some players seem to use these tactics instinctively—although rarely consistently—without ever really knowing why.

BUYING HOUSES: Monopoly rules state that houses and hotels must be built up evenly. This means that ten houses bought for three properties must be distributed 3-3-4. Which property should get the extra house? The best rule to follow is to *build up properties counterclockwise*. For example, with the yellow monopoly, put the first extra house on Marvin Gardens, the next on Ventnor. The only major exception to this rule is that the *second* extra house in the maroon monopoly goes on St. Charles Place, not States Avenue, because the frequency of landing on St. Charles is increased by the Chance card "Advance to St. Charles Place." There are minor exceptions to this rule in a few other monopolies, but any discrepancy will cost you less than 40 cents per turn. If you are worried about that 40 cents, then compare the properties and find the one for which the *increase* in rent for the extra house is the greatest. If all increases are the same, put the extra house on the property with the highest probability of being landed on.

MULTIPLE MONOPOLIES: If a player is so fortunate as to have two monopolies, how should he improve them? He could build them up simultaneously, or he could neglect one, even mortgage it, to have the capital to build up the other. In general, this latter approach is the best. In a game in which you are expecting to buy one house at a time, you make the best investment when you put each additional house or hotel on the same monopoly.

In contrast to house-by-house improvements, occasionally a player has enough money to build several houses at once. In this case, the rule is to *build simultaneously only if you can put three houses on each property*. The increase in rent resulting from the addition of a third house is much greater than that from the first, second, or fourth house or the hotel. Moreover, at three houses most properties begin to pay a fair return on the investment. If you cannot place three houses on each property of your additional monopoly, then you should make further improvements on the monopoly you have already started.

GETTING OUT OF JAIL: The only choice of movement a player has in Monopoly is how he will get out of jail. He can pay $50 to the bank and leave immediately, or he can wait three turns and pay the $50, if he as not thrown doubles during this time. When should a player pay to get out of jail immediately, and when should he stay? At the beginning of the game the idea is to acquire as much property as possible. Thus every turn spent in jail is harmful. But as the game progresses, properties are sold and improved, and moving around the board is injurious, because a player then has to pay rents. In jail, on the other hand, a player pays no rents for landing on property, and he might even save the $50 by throwing doubles to get out. In general, *as long as a player needs to buy property, he should pay to get out of jail. When no property is needed, he should stay in jail.*

There are two drawbacks to remaining in jail, even when all the property has been sold. First, you do not reach Go to collect $200. Ordinarily, a trip to Go leaves a player with an expected profit of $39 per turn, $33 a turn when adjusted for taxes and fees (but not rents). When a player pays to get out of jail immediately, he makes $1 more per turn. But being out on the board, he now has to pay rent. The way to determine whether or not to stay in jail is: if any monopoly has a total of four or more houses, it is safer to stay. This rule is somewhat less applicable for the cheaper monopolies; the deciding numbers for these are: light blue, eight houses; maroon, seven; and with hotels on Baltic-Mediterranean, you break even.

If you choose not to pay, you must throw doubles in order to leave jail. This means that the probability of landing on the even-numbered squares following the jail square is increased. And if your opponent happens to own the orange or maroon monopoly, there is a good chance (1 in 2) that if you throw doubles, you will have to pay rent on Virginia, St. James, or Tennessee. In this case, it might seem a good idea to pay to get out of jail immediately. However, the rents you might have to pay by being on the board two extra turns outweigh the rent you might have to pay for landing on one of these properties. For example, when there are hotels on the green properties, paying to get out of jail will cost you an extra $7 per turn.

If you are playing a Peasant game, the less money you pay in rent to your opponent, the better off you are—even if you yourself do not make as much. In a Peasant game, therefore, once the properties have been sold, *always stay in jail.*

GET OUT OF JAIL FREE CARDS: A player who owns a property to which players can be sent by Chance and Community Chest cards may think that it is advantageous to hold the "get out of jail free" cards rather than use them. The remaining cards in the two packs would recycle faster, and thus more players would be sent to his property to pay rents. The reasoning is sound, but the profits are not. Playing with only 15 cards in each deck increases the return on properties by no more than 52 cents a turn—with the greatest effect on the red monopoly with hotels. It would take 100 turns for the landlord of these properties to recoup the $50 he paid to get out of jail.

In the world of Monopoly, as in the real world of high finance, no one is a sure winner. Although these computer-devised strategies and rules greatly enhance your chances of winning, the throw of the dice will always see to it that luck has its share in the outcome. But there is always a way to tell if you are winning, even while the game is still going on. Simply compare your expected output in rent payments with your expected income from the properties you own. If you are making more than you are giving away, there is no need to worry. If you are giving away more than you are taking in, you are probably not doing as well as your opponent; but you will not necessarily lose. You still have the windfall from Go, a profit of $33 a turn that gives you an extra margin in paying rents.

The salary from Go is one reason that so many two-person games wind up in a stalemate. One person makes more profit than the other, but neither gives up more money per turn than he gets from Go. However, if output exceeds your income by more than the $33 from Go, you will lose money until you eventually slip into bankruptcy.

If the game is terminated before all but one player has gone bankrupt, you can more accurately project the winner by using the tables and charts of expected returns rather than by awarding the laurels to the player with the most cash on hand, as most players do. This means, of course, that you have to reveal the source of your shrewd game playing; but if you have used the computer as your investment consultant, the winner should be an obvious choice. □

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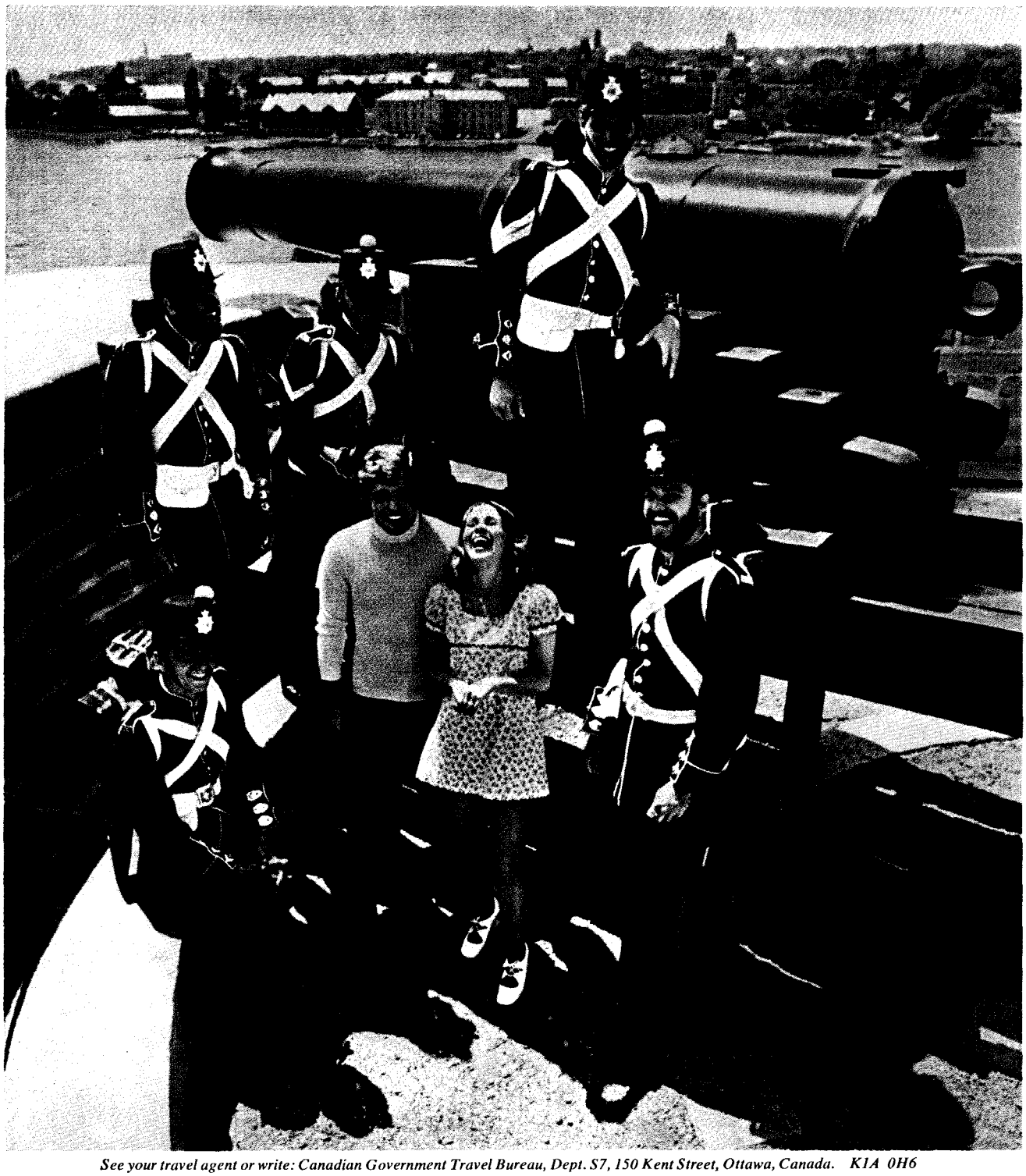

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TRAVEL/UNSPOILED PLACES

Spring is upon us, summer is near, and the time has come to start studying maps and planning itineraries. In the following pages we consider the never-ending search for unspoiled places. The quest takes us under the sea, through a rain forest, inside dark caves, and across the oceans to distant islands. The purpose, of course, is to encourage you to ask, "What *is* an unspoiled place?"—and to find one of your own.

THE HIDDEN WORLD OF CORAL REEFS

By William Eschmeyer

Travel to a coral reef is travel in search of life—life that is colorful, bizarrely shaped, largely hidden from the surface world. Marine animals compete there with an intensity rarely witnessed by man. The reefs themselves are formed by living things: corals (soft and tiny animals) live on the outer surface of the reefs; when they die, they donate their skeletons to the reefs that sheltered them. At no other place can we so intimately witness—and join for a time—the complex transactions of marine life.

Even the nonswimmer can learn much by simply walking on shallow reef flats, examining tidal pools and small channels. It is advisable to wear high-backed tennis shoes or old boots and slacks to protect the ankles and lower legs against the sharp coral. A wooden bucket with the bottom knocked out and replaced with glass adds much to viewing enjoyment. When submerged, the glass bottom blots out glare and surface ripples.

Turning over blocks of coral on the reef flat can yield a fascinating world in miniature; gloves are recommended for protecting hands. The "under-rock explorer" will find brittle stars, crabs, little sea urchins, cowries, and a variety of small fishes. It is important to remember to return the rock to its original position, since exposure to continued sunlight will kill the organisms that live on the undersurfaces of the rocks.

The requirements for deeper enjoyment of the reef and its flora and fauna are few. A pair of fins, a mask, and a snorkel enable the swimmer to float dreamily on the surface, silently observing nature's wonders below him, or one can make periodic dives to the bottom to

William Eschmeyer is chairman of the Department of Ichthyology at the California Academy of Sciences.

THE WORLD'S TEN BEST . . .

This list of the world's ten best coral reefs has been compiled to aid travelers. Obviously, no one has seen all of the world's coral reefs, and a list such as this one omits many spots. Those listed below all offer rich flora and fauna, diverse geological formations, and excellent underwater visibility, often exceeding 200 feet.

Reefs are number-coded from (1) to (5): the higher the number, the less accessible and more expensive the diving. (Veteran reef explorers point out that the best diving is usually found on the least accessible reefs.)

Two firms that specialize in tours for skin divers were consulted in the preparation of this list, See & Sea Travel Service of San Francisco and Bay Travel, Inc., of Corona del Mar, California, as were other divers and scientists.

Andros Island (1), Bahamas, is internationally famous for The Wall, a near-vertical drop-off to 6,000 feet from its 120-mile-long reef.

Grand Cayman (1), in the Caribbean, has excellent diving off the entire coast, noted especially for barrier reefs with shipwrecks and unusually rich sponge fauna.

British Honduras (2) boasts the second longest barrier reef in the world; 40–60 miles off Belize lies a rich maze of South-Sea-like atolls with ravines, drop-offs, and caves.

Bonaire (2), off Venezuela, offers rich fish and coral populations; the "color wall," which plunges to 2,000 feet, exhibits huge gorgonia.

Cozumel (2), 20 miles off the Yucatan Peninsula, features the world-famous Palancar Reef, with its winding coral canyons, broad flows of white sand, and innumerable precipices and caverns.

The Red Sea (3) was only discovered as a diving mecca in the mid-1960s. Best spots lie between Hurghada and Suakin, although access to much of the Egyptian coast is off-limits. The area can also be approached from Eilat, in Israel, or Port Sudan.

Tahiti (4), although not itself a site of great diving, is the jumping-off point for the Society Island reefs, particularly Tetiaroa (owned by Marlon Brando), Maupiti, Tubai, and Rangiroa. Better yet—and even less accessible—are the Tuamotus.

The Great Barrier Reef (5), stretching 1,250 miles along Australia's east coast, provides better diving the farther you get from the continent—best of all in the Coral Sea. Many areas are over-spearfished, but Green Island and Gladstone are good points of access to undisturbed spots.

Galapagos Islands (5) are nearly virgin territory for skin divers, but the unusual mingling of warm and cold currents creates extraordinary opportunities for fish watching.

Palau Islands (5), in Micronesia, became accessible only in 1968, when Continental/Air Micronesia began flying to Koror. Paul Tzimoulis, publisher of *Skin Diver* magazine, calls it "the best diving spot in the world." In the lagoon of Truk Island, which can be seen on the way, lies much of the sunken Japanese Imperial Fleet.

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observe activities more closely. SCUBA (which stands for "self-contained underwater breathing apparatus") diving, although not for beginners, is the best way to explore the underwater world.

The satisfaction gleaned from diving or snorkeling far outweighs potential hazards. Stinging, venomous jellyfish, such as the man-of-war and the sea wasp, are generally problems of a regional or seasonal nature. The likelihood of your stepping on a venomous stonefish or one of its relatives, being attacked by a barracuda or shark, stung by a cone shell mollusk, or bitten by a moray eel are remote. Experience soon will enable you to avoid "stinging coral"—not a true coral—and long-spined sea urchins.

The coral reef habitat is an ancient one, and evolution of the reef organisms has proceeded along many lines of specialization. The result is a community of many species and great complexity. The organisms can be divided into two types: sessile (or fixed) and swimming. Dominant sessile organisms include the corals, alcyonarians (or soft corals), "rooted" algae, anemones, sponges (which are animals), and some mollusks (such as the giant clam, *Tridacna*). Mobile or swimming animals include fishes, most mollusks, echinoderms such as brittle stars and starfish, crabs, and such grotesque creatures as the sediment-ingesting sea cucumbers, which generally move only as fast as they can eat.

IF AN ADULT ANEMONE FISH DIES, SEVERAL OF THE SMALLER FISH WILL SUDDENLY GROW TO FULL SIZE.

You will be amazed by the array of colorful fishes and the bewildering variety of corals, including staghorn, elfhorn, brain, fan, lettuce, pink, and black. If you are diving in the Caribbean, you will see different species of fishes from those you would see in the Indian or Pacific oceans. Surprisingly, though, you can see many of the same species in Tahiti that are found thousands of miles away off eastern Africa; the reason for this is that the Indo-Pacific area from Africa to the central Pacific forms one faunal province with no real barrier to prohibit the distribution of animals. The deep, un-islanded eastern Pacific, on the other hand, forms a barrier that is difficult for central Pacific fishes to cross. Ichthyologists estimate that there are probably 20,000 different kinds of fishes, and perhaps a fifth of these are inhabitants of coral reefs. On most reefs the animals are poorly known, and many still have not even been named; invertebrate animals are even less well-known than the fishes.

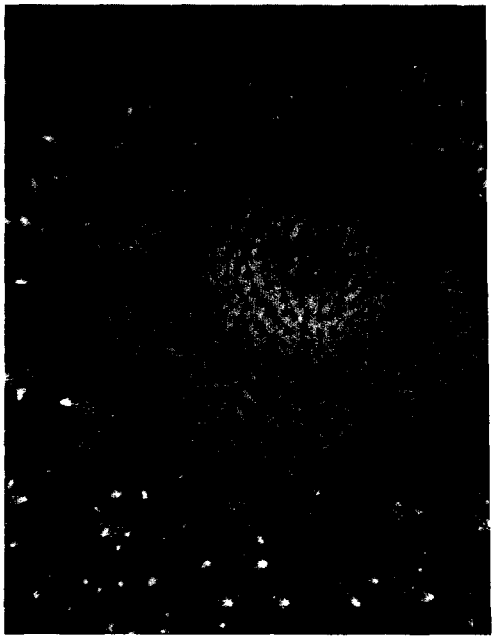
With a little thought and study it soon becomes easy to recognize the major types of reef fishes, which are similar no matter where the reef is located. Obvious types are the gaudy blue-and-green parrot fishes, the colorful angelfishes and butterfly fishes, surgeonfishes with a spine just in front of their tail fin, large schools of snapper-like fishes, and a host of little fishes that grow no longer than a couple of inches. As a general rule, you can see a greater variety of animals doing more things by sitting in one spot and watching carefully than by swimming aimlessly over the reef.

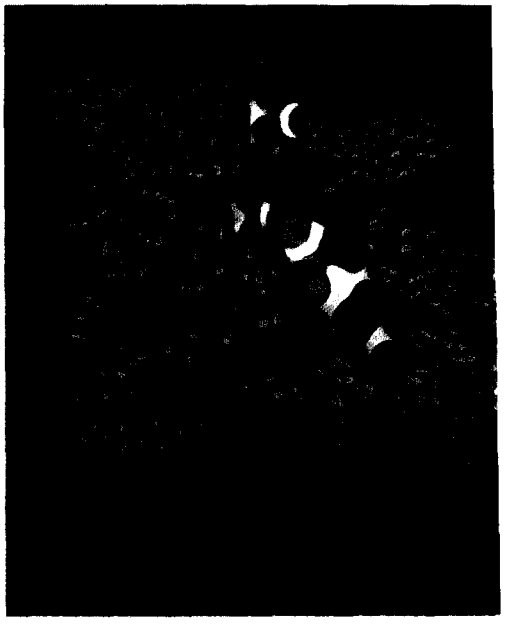
In the course of evolution some peculiar animal associations have developed. If you can find a sea anemone, you will almost certainly find, in the Indian and Pacific oceans, an anemone fish (commonly called clown fish). The anemone commonly looks like a patch of deep-pile whitish carpet; the clown fishes are small and brightly colored, usually marked with one to three prominent vertical stripes. The anemone fishes remain in breeding pairs with one anemone for their whole lives. This association is profitable for the fish, since it gains protection from predators by darting down into the anemone's stinging tentacles (the anemone fish is immune to the toxic tentacles of its host). At night the fish settles deep among the tentacles. Hovering within the anemone are usually several stunted clown fishes; if one or both of the adult pair dies, several of the smaller fish will suddenly grow to full size and compete violently for the vacant position.

Another specialized "niche" is occupied by parasite pickers, or "cleaners." Certain brightly colored shrimps and some fishes are known to pick parasites, injured tissues, and other debris from the bodies of reef fishes. The cleaners actually maintain "stations" where the fishes come to be picked over, and the host fishes in return know not to eat the shrimp.

There are far more species on the reef than you can actually see. Some fishes and invertebrates live far back in crevices and holes in the reef; others live under the sand; some kinds of fishes and shrimps live inside sponges; and one group of peculiar fishes lives inside sea cucumbers. The more you search, the more you will be rewarded for your efforts.

If you watch the fishes carefully, you will be able to see many examples of feeding. One method is to break open a sea urchin, place it on the bottom, and move a few feet away. The response of the reef inhabitants will be rapid and gratifying. You should be able to classify feeding into several categories. The most obvious group includes the large fish predators that usually swim some distance over the reef; these include jacks, barracudas, and other large fishes. A second group is made up of benthic carnivores, which feed on bottom-living fishes. A third important group includes the algal or plant feeders, such as the parrot fishes and surgeonfishes, which gnaw on the coral and excrete it in the form of sand. A fourth group consists of plankton feeders; some small fishes are adapted to rise above the reef and pick tiny animals from the passing





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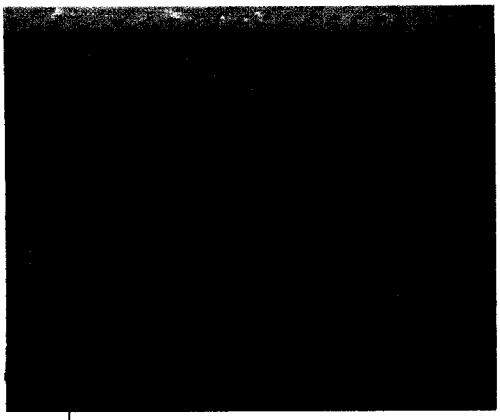
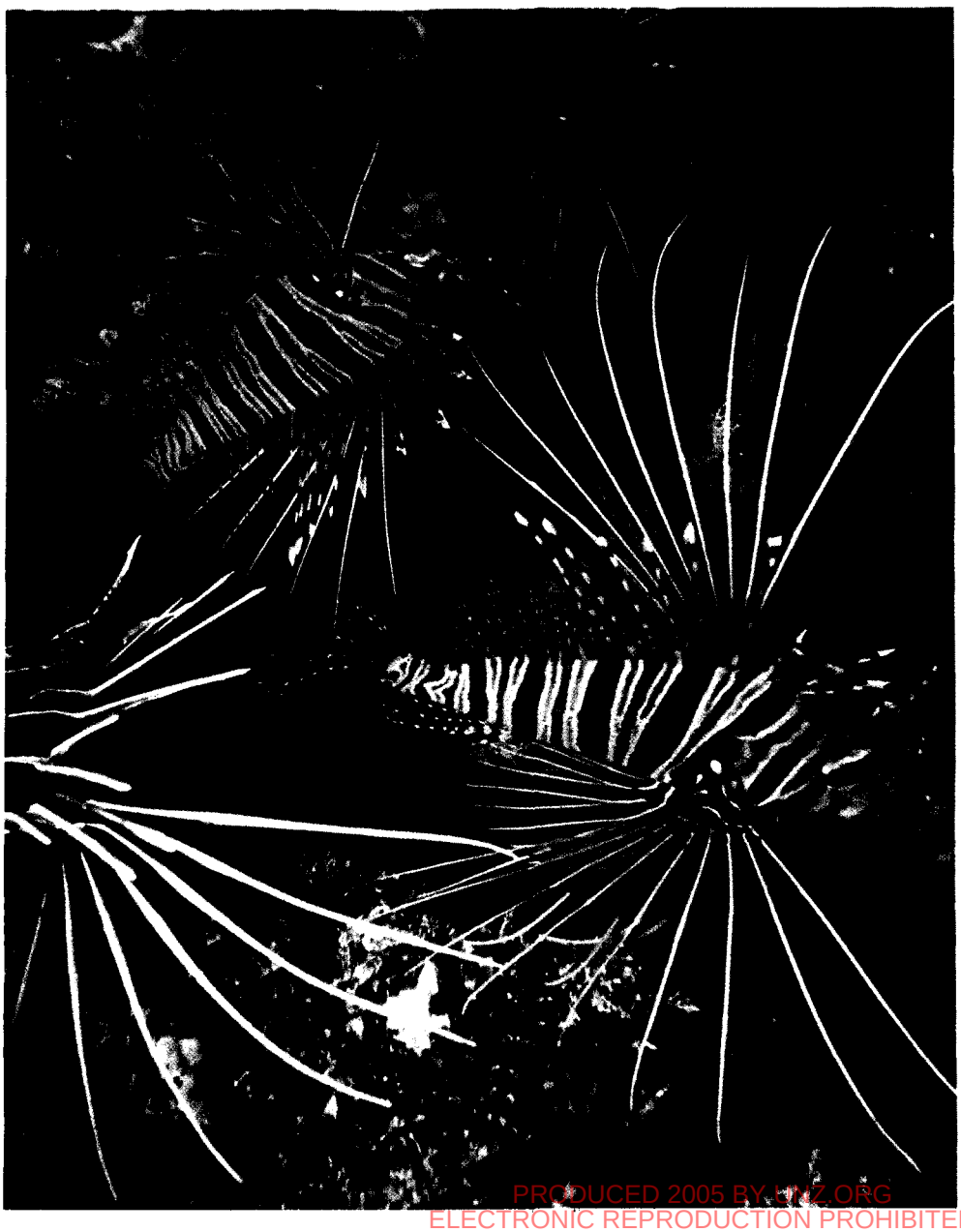
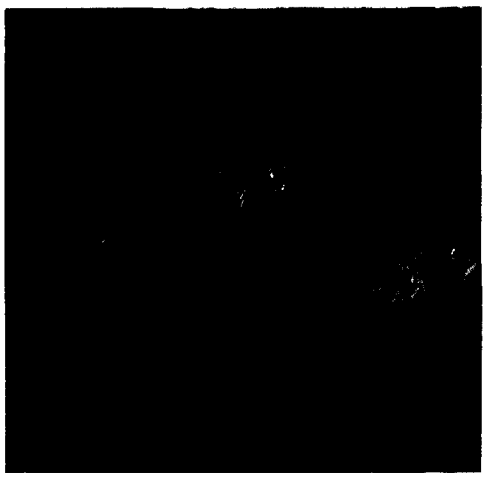


Glover Reef (above), off British Honduras, is a typical barrier reef. Below left are a crown-of-thorns star fish, photographed off New Caledonia, and a sea anemone with clown fishes near Australia. Below center are lion-fishes in the Society Islands. Below right are a rare reef fish (top) from Australia, known only from two specimens; cardinal fish (middle) from the Red Sea; and a brilliant nudibranch, or shell-less snail, from the Coral Sea.

plankton. These fishes are active only in the daytime, and you should be able to see them darting up in the water column and then returning quickly to the protective interstices in the coral.

A coral reef community at night is vastly different from the same area during the day. If you have a chance and can locate an easily accessible protected swimming area, buy a waterproof flashlight or underwater light and try a swim in the same place both during the day and at night. During the day the grazers, such as the blue-and-green parrot fishes, are actively feeding. Large schooling fishes swarm over the reef. At night the gaudy-colored parrot fishes are "sleeping," some in protected crevices or holes and some surrounded by a mucous cocoon, which they secrete around themselves each night. The schooling, snapper-like fishes have all left the reef and range over adjacent sandy areas in search of food; these fishes use the coral reef only for protection during the day. Many of the mollusks and crustaceans, such as crabs and shrimps, are much more active at night. Recent studies as part of the Tektite Program (a scientists-in-the-sea project coordinated by the Office of Naval Research in the Virgin Islands) show that the day-active species "wake up" at rather precise times near daybreak. Some species are early risers and others are late risers, but the whole changeover in the morning takes only about an hour. In the evening the reverse occurs, and the day-active species withdraw into protected areas of the reef. The Tektite workers found that the day-





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active species retired by sunset but that the nocturnally active species waited about a half hour after sunset before coming out. Many fishes have different color patterns at night.

If you visit a reef in the Pacific or Indian Ocean, chances are good that you will see the infamous crown-of-thorns starfish. Since the early 1960s this animal has undergone a population explosion in scattered areas in Hawaii, Guam, Fiji, New Caledonia, Palau, Borneo, and the Great Barrier Reef. The crown-of-thorns, growing to about 18 inches in diameter and with a dozen or more arms, bears spines covered with a toxic mucous. It eats coral by everting its "stomach" and digesting the soft polyps. The enemies of this animal are few; the most important predator of adult starfish is the large triton mollusk. In plague proportions these starfish may destroy up to 80 per cent of a reef, then migrate to nearby reefs. In 1967 Dr. R. Endean counted 5,750 starfish in one swim at Green Island on the Great Barrier Reef. Speculation about the cause of the population explosion has ranged from pesticides to shell collection, which may have reduced the numbers of the predator tritons. A more realistic suggestion may be that this is a natural, cyclic phenomenon.

Most visitors to a coral reef wish to take home a few special shells or bits of coral as souvenirs. However, what usually happens is they are not cleaned properly and give off wretched odors. Then they are discarded. Our recommendation is to photograph the animals but not to remove them from the reef, or to collect shells on the beach. Underwater cameras can now be purchased relatively inexpensively, and colorful slides can record far more than can be brought home in a bag. That way, the colors don't fade—either in your home or on the reef. □

THE MAKING OF A REEF

A coral reef is formed by a special cooperation of rock, water, and living organisms. Tiny plants called coralline algae secrete a limy glue that binds bits of sand, broken shells, and chips of coral into a brownish rock. The rock supports the living coral and acts as a buffer against the constant wave action that would otherwise upset the whole environment. Often scoured to a shiny smoothness by the relentless activity of the sea, the coralline rock provides a footing along the wave line and protects many islands from erosion.

The corals themselves are communities of animals called polyps. These polyps secrete skeletons of calcium carbonate, or limestone, in a candy-store range of colors and shapes. Polyps feed by extending tiny tentacles, like those of a miniature sea anemone, to catch minute planktonic animals that the ocean currents bring within reach. Corals reproduce when a new bud branches off between two adjacent polyps, and continue to grow, under favorable conditions, unless the skeleton is broken by wave action. This broken coral provides much of the raw material for the coralline algae, which construct something less than an inch of new reef per year.

The existence of the reef is also dependent upon yet another type of algae, called zooxanthelle, tiny cells that live within the polyps themselves. These algae, much like those in lichens, seem to help the corals by increasing their oxygen supply and removing waste products. Since the zooxanthelle need bright sunlight for photosynthesis, they are not usually found below depths of 100–150 feet, effectively limiting the depth at which coral communities can flourish. (In contrast, solitary, non-reef-forming corals may live in deeper or cooler waters.)

Coral reefs make other, quite special demands upon the environment, which explain why they are found in relatively few zones of the world's oceans. There must be constant ocean currents to provide food. The water must contain between 25 and 40 parts of salt per thousand parts of water (freshwater salinity is less than one part per thousand). The ambient temperature must remain above about 68° F. The water must be very clean, since silt and other suspended materials quickly clog the polyps. This is happening, for example, along some near-shore stretches of Australia's Great Barrier Reef, where natural and man-made erosion from the continent hampers reef growth.

These rather precise requirements account for the restricted distribution of coral reefs. The earth's rotation and the associated wind patterns cause cold-water currents to flow toward the equator in the eastern Atlantic and eastern Pacific, excluding reef-building corals from these areas. The currents then warm as they flow westward along the equatorial zones of both oceans. Hence coral reefs are found mostly on the warmer western sides of oceans and in open tropical sea. Southern Florida is the only place in the continental United States bathed by waters warm enough for reef-building coral; here, however, silt from dredging operations hinders good growth.

Even when water conditions are right, a spectacular amount of geological preparation is required to make a reef. In 1837 Charles Darwin proposed a theory—still largely accepted—to explain the origin of the three kinds of coral reefs. First, he wrote, volcanic mountains that rise above sea level are gradually surrounded by *fringing* reefs, as seen around the Hawaiian Islands and Tahiti. When volcanic activity ceases, Darwin postulated, these mountains sink slowly enough for upward coral growth to maintain a ring of reefs at the surface in the clear, moving water that coral needs. The downward tilting of a continental margin would achieve the same effect. In time this process develops a *barrier* reef, extended, largely submerged reefs, as seen off Australia and eastern British Honduras.

The final phase in the evolution of most reefs, said Darwin, is an *atoll*. After a mountain has become completely submerged, it leaves in its place a flat, coral-covered platform. The next step, worked out largely by American geologist Reginald Daly in the 1930s, accounts for the curious fact that almost every lagoon in the world is approximately the same depth, about 100 to 200 feet. After the end of the last Ice Age, about 12,000 years ago, melting ice caused the ocean level to rise some 150 feet. As the water rose, the coral around the edges of the platforms rose with it, growing quickly from its direct contact with the open sea. In the more stagnant lagoons the coral grew little, if at all, filling instead with water. □

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Advertisement

You're going abroad.

You're a little bit nervous.

You're normal.

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Most people on the verge of taking a vacation abroad (particularly if it's their first one) will readily admit to feeling a bit apprehensive.

And with good cause.

Because underneath all the hoopla of going, there is a feeling of uncertainty, "Will it turn out to be everything I want it to be?"

Well the truth is, it depends largely on you.

If you go unprepared, then a lot of little things can crop up which can make your vacation a lot less than you want it to be.

And that's exactly what we can help you avoid.

At Pan Am we've been flying for 45 years, taking people to Europe, Latin America, Hawaii, the Pacific, Africa, and the Caribbean. And we've amassed a tremendous amount of knowledge about traveling abroad. Knowledge that can help you.

And since scheduled airlines charge th same fares over the same routes, you don't pay any more for the extra help you get when you fly with us.

We can tell you everything you have to know about where you're going.

We can give you some pretty good idea: on where to go if you haven't yet made up your mind.

And we've put all this information into books, booklets, tape cassettes, and pamphlets, available at Pan Am travel agents and Pan Am offices, so that you can share our years of experience.

This booklet will give you a pretty gooc idea of what we mean.

When you pack for a vacation abroad, remember you're only going to visit.

There is nothing more aggravating than being weighed down with a lot of excess baggage. Especially when you don't have to be.

The trick to "traveling light" is in the kind of luggage you use (it should be as lightweight as possible) and the amount of imagination you employ in packing.

Women will find that a cocktail dress will see them through all but the most formal occasions.

And a dark business suit, sports jacket and slacks will do the same for men.

And if you stick to one basic color theme you'll find that "mixing and matching" gets you a lot of mileage out of a relatively small amount of clothes. So the best advice we can give you is to take only clothes that you can interchange. That way you will be able to make up a variety of outfits. (Another bit of advice: leave furs and jewelry home unless you really need them.) The thing to watch out for is shoes.

They're heavy and they take up a lot of space so try to take a maximum of three pairs, one of which should be good walking shoe already broken in.

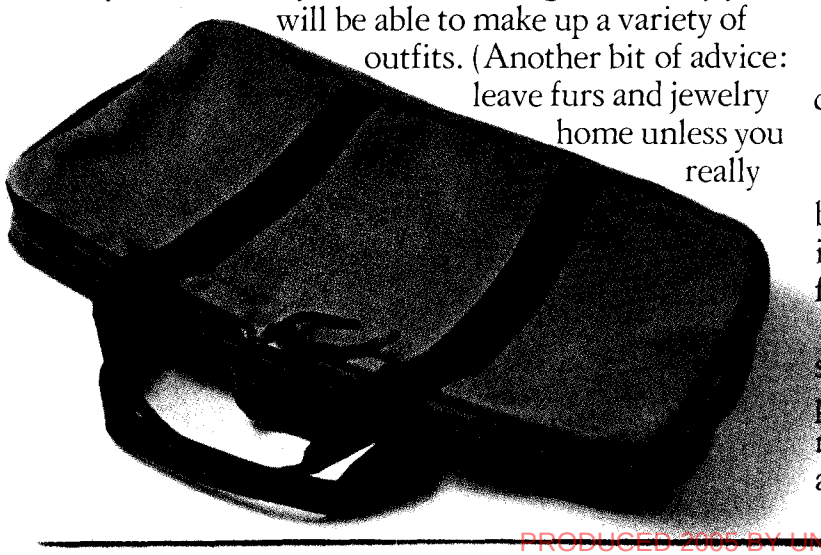
If you're required to take pills or other prescription items, take enough to last your entire trip. Brand names of medicines differ from country to country and you might not be able to get refills, so it doesn't pay to take chances.

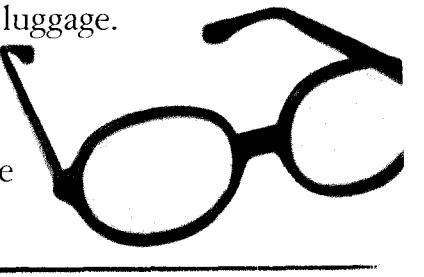
The same goes for eyeglasses. Take an extra pair, if you have one. (Broken glasses could cost you a half a day's sightseeing.)

One last tip.

Since you'll undoubtedly be coming back with more stuff than you left with, buy an inexpensive, collapsible suitcase here which can fit neatly into your luggage.

This will save you the expense of buying more costly luggage abroad.





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Getting a passport.

To get a passport you will need to show proof of U.S. citizenship. Your birth or baptismal certificate will do. If you cannot produce either, then an affidavit attesting that you were born in the United States is sufficient providing it is signed by a relative or person who has known you for a long time.

You will also need some form of identification that bears your signature, such as a driver's license.

Two identical photos, front view, 2 ½″ to 3″ square on a white background, and you're ready to apply.

Application must be made in person. At your county clerk's office, in some areas at your post office, or in most large cities at the Passport Agency of the Department of State.

It costs $12.00, and normally takes a minimum of two weeks for you to get your passport from the time you apply (three in the Spring or Summer) so don't wait till the last minute.

While you're traveling keep your passport with you at all times except when you have to turn it over to your hotel for registration purposes.

Do not pack your passport in your luggage. Should you lose your passport report it to the nearest American consulate or embassy.

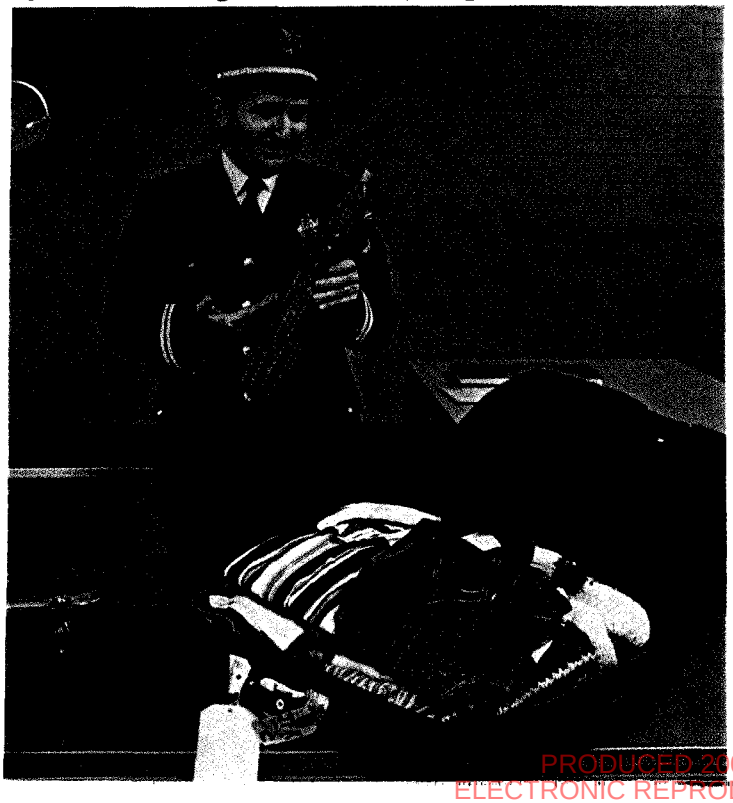
Shots.

You can stop wincing. Most countries require no shots nowadays. However, it is wise for you or your travel agent to check with us regarding the specific countries you're going to.

And if you do have to get any shots, take them well in advance of departure as you may experience a day or two of discomfort.

An explanation of U.S. Customs regulations before it's too late.

The last person in the world you want to hear an explanation of U.S. Customs regulations from is the Customs Inspector who goes through your luggage on your return home. Because if he has to explain something it probably means you have something in your luggage you shouldn't have. So rather than getting embroiled in that kind of situation it's a good idea to know what you can't bring back before you go.



You can't bring back meat products, fruits, vegetables, plants or plant products without special permits usually unavailable to the tourist.

The same holds true for the skins and hides of animals classified under "endangered species" (leopards, alligators, etc.). Products from North Korea, North Vietnam, Southern Rhodesia and Cuba are also banned.

You can bring back almost anything else.

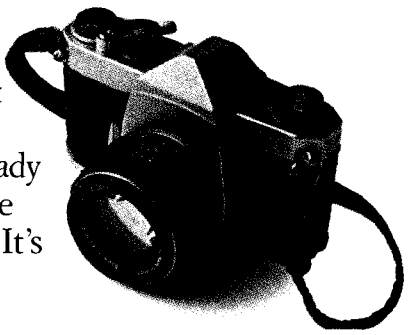
And you're exempt from paying duty on the first $100 worth of merchandise. ($200 worth from the U.S. Virgin Islands and Guam.)

Once you're over the exemption you must pay duty, but even that leaves room for bargains.

Buying a watch that sells for $50 abroad, for example, and paying duty is still a lot better bargain than buying the same watch here for $90.

One last point.

If you own a new camera of foreign make and you plan to take it abroad with you, remember to register it (a quick, painless process) with U.S. Customs officials before you leave. You don't want to pay duty on something you already own when you come back. (Don't laugh. It's happened.)



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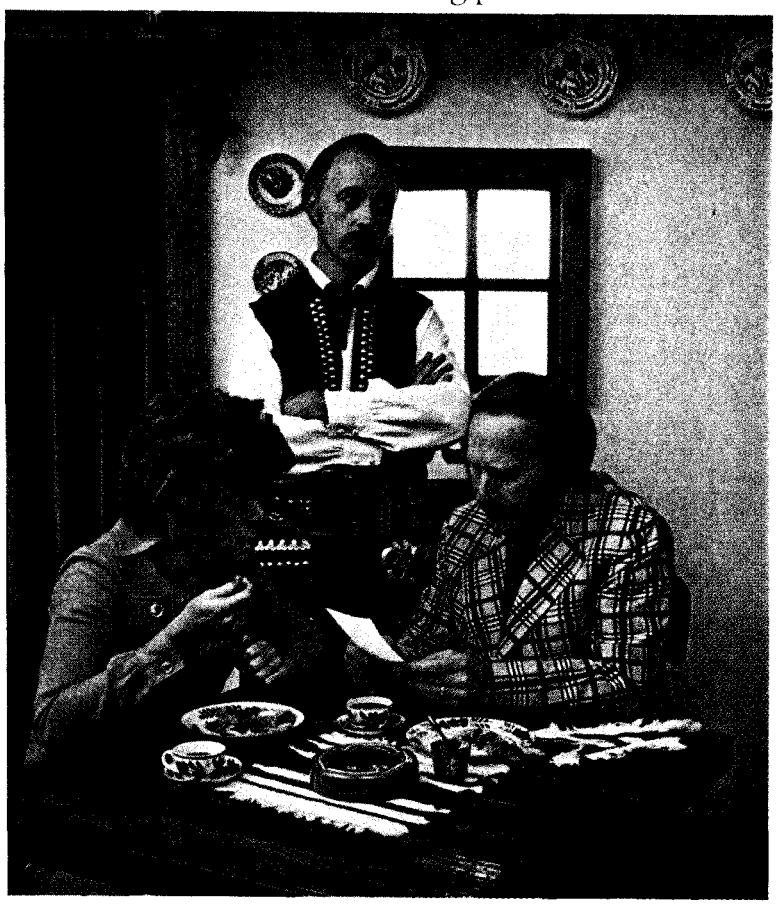
How many Groszys do you tip the waiter if the check comes to 87 Zlotys?

Handling foreign currency is not one of the American tourist's strong points.



And while it may be funny to hear stories of how someone tipped some waiter $5 on an $8 meal, or bought a pair of shoes for $45 when he thought he was paying $16, you're not going to find it funny if it happens to you.

And the only way to avoid it is to "learn something about the currency of the countries you're going to visit.

To help you do that every copy of our Clipper Magazine, available free on Pan Am flights, has an up-to-date currency converter chart.

Using the chart, you'll be surprised how fast you'll come to think of a British pound as about $2.50. Or a 100 Polish zloty note as about four dollars.

And when you understand the currenci then you can read up on the tipping procedures for the different countries. (Pan Am's comprehensive new "World Guide" gives particulars for each country.)

It also helps to understand the art of overtipping.

If you plan to return often to a place, the breakfast room of your hotel, for example, be a little generous the first time. It pays dividends.

How you can get the best rate of exchange.

For the most part, travelers checks and credit cards are the answer to money problems abroad. Most hotels and stores accept them.

Should the need arise to convert a large amount of dollars into local currency, you'll find the best official rate of exchange at banks and "exchange" houses. (Hotels tend to be somewhat less generous, although the convenience of exchanging money at the hotel may well be worth i

Change only as much American money into local currency as you think you will need, because you can lose money exchanging one foreign currency into another foreign currency.

And in case you run out of money, you c cash an emergency check of up to $50 at any Pan office just by showing your Pan Am ticket.

The art of sightseeing.

Before you go sightseeing, it's smart to have some idea of what you want to see.

To help you do this, you can buy Pan Am "Tours on Tape," handy little cassettes that consist of walking tours around major cities of the world, complete with maps.

You can play the cassette before you leave the hotel, and then take it right along with you and have your own "guided" tour. (Incidentally, this is where those broken-in walking shoes come in. You won't want to have to skip things because your feet are killing you.

We also have Pan Am City Map/Guides that not only tell you things to see, but also places to eat and shop, for major cities arour the world.

One very important thing. Some people actually avoid the great sights, like the Eiffel Tower for example, because they feel they're too touristy. But once you're on top, looking out over all of Paris, you'll realize hov silly an attitude like that is.

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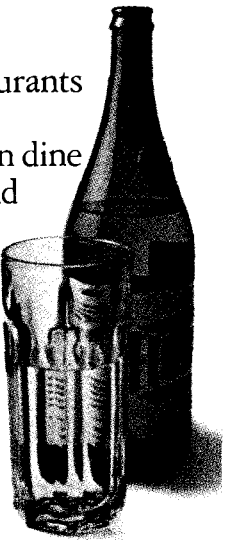
What to eat, what to drink, and where to eat and drink it.

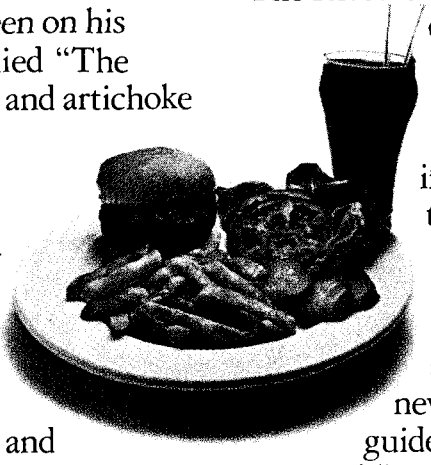


tells you about food and lists restaurants throughout the world.

It tells you where you can dine like a king at kings' prices and where you can dine like a king at your prices.

And can direct you to where you can get a mineral water in Italy that was recommended by Michelangelo back in the 15th century or to a meal in Japan for only $.30 (soba-buckwheat noodles, meat and vegetables).

We also have a handy new book called "The Real Restaurant Guide to Europe" that not only tells you about the best restaurants, but also tells you where to get the best food for the money.



And, wherever in the world you are, the people in our Pan Am offices can recommend the places they know about that are too new to be in anybody's guide book.

(They can even tell you where you can get a hamburger if you get a little lonesome for home.)

A famous movie star when asked what was the greatest thing he had seen on his trip abroad, was reported to have replied "The veal cordon bleu with pomme souffle and artichoke vinaigrette."

The chances are he wasn't kidding.

Food abroad is a much different thing than food here.

In fact, you'll probably start to regret that you only have three meals a day to give to your stomach. (Providing you eat in the right places and order the right things.)

Which is where we come in.

Our new "Pan Am's World Guide"

The best buys.

Between the last great monument and the next great meal there is always time to indulge in that great American pastime. Shopping. The trick, as in eating, is to know where to go and for what.

Our Pan Am Shopping Guides contain information on shopping in more than 85 countries around the world.

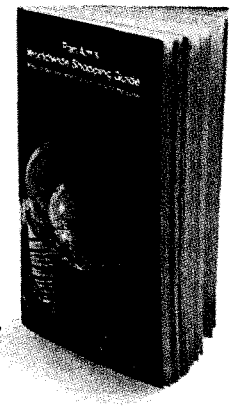
They tell you what the best buys are in each country (topazes, amethysts, aquamarines and tourmalines in Brazil) and even what stores to go to.

They also tell you where you can bargain and where you can't. (You can in Morocco. You'll be wasting your time in Switzerland.)

How about a place where you get a 15% discount for using travelers checks? Or a 20% deduction on luxury items (gold, silver) provided you send them directly to your home in the U.S.

The Shopping Guides also give you a chart which lets you convert your American clothing sizes into the sizes used locally.

And of course, the people in our local offices are available for tips on the latest bargains.



The nicest thing about shopping abroad, however, is that it's more than a collecting process.

Walking and browsing in places like the covered bazaar in Istanbul, Paris' flea market or the floating markets of Thailand expand your knowledge and appreciation of the places you're visiting. Even if you don't spend a nickel.

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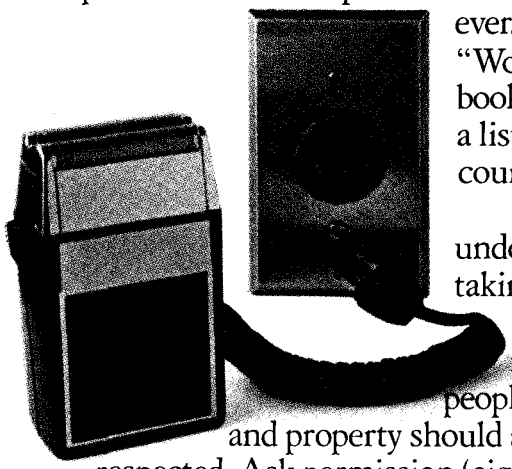
Common courtesies, local customs and things to watch out for.

Good manners are universal. Please, thank you and you're welcome go a long way anywhere in the world.

If you can learn to say them in the local language you'll be a step ahead of anyone who can't. If you can't, English will do just fine. In most countries a handshake or a slight bow serve as a hello or a goodbye.

If you are invited to someone's home a small present (flowers, candy) will be deeply appreciated. (Shoes off in many places in the Orient.)

In many countries (Turkey, Japan just to name two) a polite burp at the end of a meal is a compliment not a faux pas. Don't overdo it however. (Our new "World Guide" book sets out a list of common courtesies.)

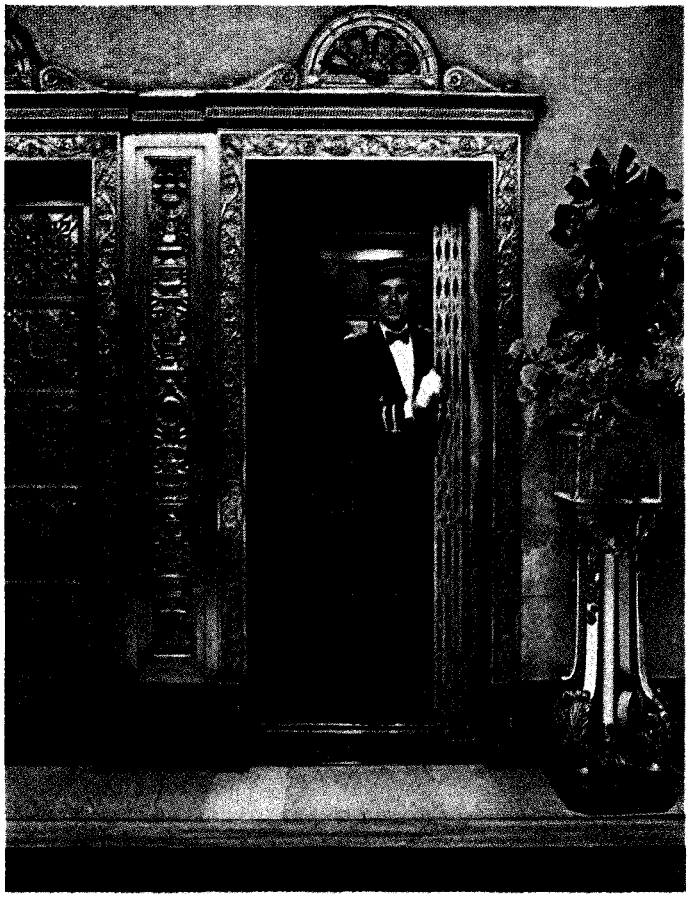


Since you'll undoubtedly be taking a camera please remember that people's privacy and property should always be respected. Ask permission (sign language works) before you shoot.

A few things to watch out for.

The electrical current in some countries may not be compatible with your shaver or hair dryer. Check it out first. (Or better yet, take along a voltage converter which you can buy at most appliance stores here before you leave.)

In small buildings in France an elevator will take you up, but you are expected to walk down.



In Amsterdam, a great place to buy expensive diamonds cheap, there are people who sell cheap diamonds expensively. Since you can't tell the difference readily, only buy in reputable places.

As a matter of general information, don't buy from people who approach you on the street with "deals" anywhere.

Different ways to go.

The whole question here is, "to tour or not to tour?"

But before you jump one way or another you should know what a "tour" is.

Nowadays, a tour is a pre-arranged vacation plan. In some cases it involves traveling with a group.

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Altogether we have 1500 tours to places all over the world.

We have tours where every single detail is taken care of. You don't have to worry about tipping, speaking the language, the customs, what sights to see, where to eat or anything.

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Here we take care of your air travel, set you up with hotels and inns and arrange car rental for you and outside of that, you're on your own.

We also have some very special tours that we call our "Pan Am's World" tours. And we offer them to Europe, the Pacific, Latin America and the Caribbean.

We have them for the person who's never

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been abroad, and for the person who has been somewhere before, and wants to go back to see it in more detail.

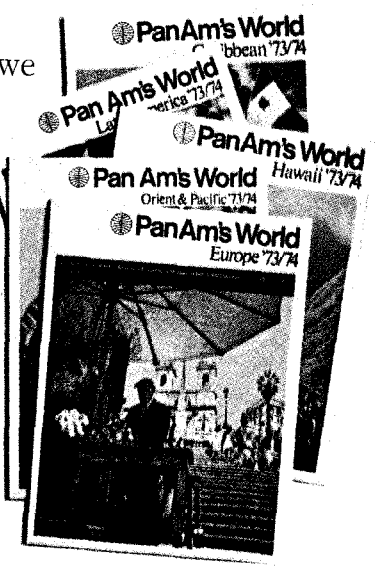
And we have them for people who have a lot of money to spend or a little money to spend.

And every Pan Am's World tour gives you everything it promises. (We even have "Tour Testers," people who stay at the hotels on our tours to make sure they are maintaining good service. If they aren't, we take them off our tours.)

And, of course, if you want to, you can always "go it alone."

The people who do this usually have no itinerary or at least a loose one, and just take things as they come.

If you want, we can arrange to have a Pan Am's World Rent-a-Car waiting when you arrive. We have a wide selection of models. And in many cases you can pick up a car in one city, and leave it in another at no extra cost.



Going on your own is a great idea. But it doesn't hurt to be somewhat familiar with the language. (We have a "pocket translator" that can help you.)

And whether you're going on your own, or on a tour (or even if you don't know where you want to go yet) a good idea would be for you to visit a Pan Am travel agent or Pan Am office, where you can browse through our Holiday Travel Center, with color brochures explaining the vacations we offer all over the world.

What's the best time to vacation abroad?

Air fares and the cost of hotel accommodations vary from season to season.

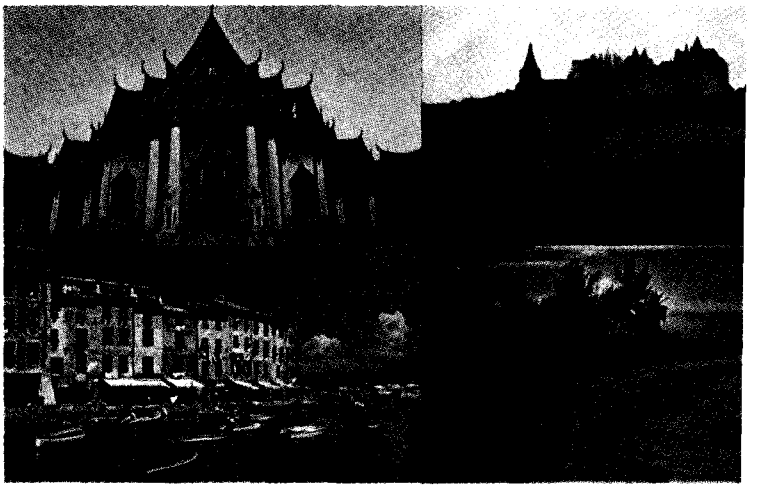
If you want the most vacation for your money, the best times to travel are when other people aren't.

For example, to Europe in the winter, and the Caribbean in the summer.

However, some places like the Pacific cost about the same the year around, because they're relatively uncrowded the year around.

Your Pan Am travel agent or the people at a Pan Am office can explain how the cost of air fares and accommodations can vary at different times of the year.

And, if you want, they can also arrange for you to charge your trip on a Pan Am Take Off Card or Pan Am's World Travel Credit Plan.



Airlines charge the same. Airlines don't give you the same.

One thing *not* to consider in choosing an airline is what it will cost you.

Because all airlines that belong to the International Air Transport Association charge the same fares to the same places.

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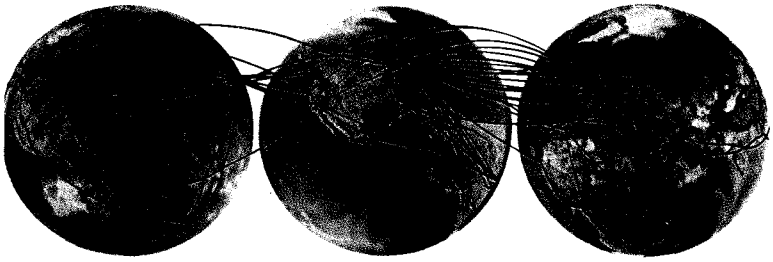

In our offices you'll find people who do a lot more than just sell tickets and confirm flights.

We can give you tips on interesting side trips you may want to take.

We can even perform as your post office, so you can keep up with your mail.

We have our own Pan Am's World Rent-a-Car system in Western Europe, Israel and Morocco and will soon have it in other parts of the world.

We have our own Inter-Continental Hotels in 43 countries. (Every hotel is different. But our high standards of service are the same.)

And if you fly on Pan Am via New York, you'll find another kind of service.

Our new terminal at Kennedy Airport, the largest private air terminal in the world.

It's designed to make your stay on the ground shorter and more pleasant. (You can be driven right up to your gate. And we have our own U.S. customs and a unique baggage-handling system.)

There's another part to our service. An important part.

We are the most experienced airline in the world.

We were the first airline to fly the Atlantic, the Pacific, to Latin America and around the world.

We opened more of the world to air travel than all other airlines combined. And we introduced almost every plane into commercial service. From the beginnings of international commercial aviation, right through to the 747.

Our knowledge and experience in this area is so vast that 24 of the world's airlines sent their pilots and crews to us for training.

As you can see, Pan Am is a lot more than just a hot meal and a movie.

Of course, we're pretty good in that area too.

In fact, we started it all by being the first airline to serve meals and show movies on board a plane.

Another innovation of ours is First Class dining rooms on our 747s. And if you fly economy class, it might interest you to know that last year 13 of the world's airlines came to us to prepare meals for them too.

What it all adds up to is this.

We help you before you go, help you while you're there, and give you a pleasant flight in between.

So if you're planning a trip abroad, see a Pan Am travel agent. Or visit a Pan Am office. Or send in our coupon.

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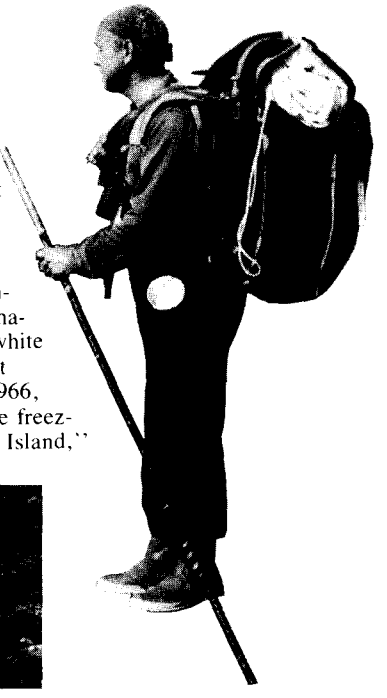
A NOT VERY METHODICAL SR SURVEY OF SOME SCIENTISTS & THEIR FAVORITE UNSPOILED PLACES

By Ava Swartz

Scientists are different from the rest of us. Because they are trained to study the mysteries of the world, they see what most of us ignore. *SR* recently asked several scientists to describe their favorite unspoiled places, in hopes of glimpsing the world through scientific eyes. The answers we got were as varied as the scientists: one ecologist chose Queensland, Australia, for its fascinating termites; a biologists said he preferred the beauty of his own backyard. A few of the responses shed more light on the scientists than their sciences, but most give fresh meaning to the idea of an unspoiled place.

DOUGLAS PIMLOTT
BAFFIN ISLAND



"Baffin Island is unspoiled as far as human impact is concerned, but it's a pretty austere place," according to Douglas Pimlott, University of Toronto professor of zoology and wolf specialist. Located about 100 miles off the coast of Northern Quebec, Baffin Island's icy terrain makes it a natural habitat for the "ghosts of the Arctic," pure white wolves that weigh from 60 to 100 pounds and hunt the caribou bucks. Pimlott spent the summers of 1966, '67, and '68 studying the wolves and caribou in the freezing Arctic weather. "I enjoy the solitude of Baffin Island," he said.

HALTON ARP
SICILY, ITALY

"The thing that drove me wild about Sicily was that there was no women's lib," said Halton Arp, Hale Observatory astronomer. "All the women stayed in the kitchen—very unspoiled."

H. BENTLEY GLASS
LONG ISLAND, N.Y.

Born in Laichow (now Yehsien), Shantung, China, H. Bentley Glass, distinguished professor of biology at the State University of New York at Stony Brook, finds his own home a refuge. "It's on Long Island Sound, facing west, with beautiful sunsets and its own beach," said the 67-year-old biologist. "I hardly find any need to get away. Actually, I'm always trying to find an excuse to get back here." What does he do there? "I look out across the beach and water as the sunlight changes and the clouds form and reform. The worse the smog is in New York, the prettier the sunset is here."

LAMONT COLE
QUEENSLAND, AUSTRALIA

LaMont Cole went to Australia last summer for the Fourth International Congress on Human Relations, held in Melbourne,

At Karumba in Queensland, the Cornell ecologist toured a large prawn fishery. "One day I watched a ship unload 30,000 pounds of 'tiger prawns,' " said Cole, who fears that the area will soon be overfished. He stayed at the Karumba Lodge—"the only place to stay, with bowls of cooked prawns on tables, to be eaten like popcorn." While there, he arranged to view the nearby termite mounds.

"Because of the prawn fishery, there is an office of the Commonwealth Scientific and Industrial Research Organization housed in a trailer in Karumba. I walked over and introduced myself. They broke out a Land Rover and drove me out several miles into the bush to see the termites."

The mounds are composed of a cement-like material that the termites manufacture by chewing mud mixed with their saliva. The largest mounds, known to the Australians as "magnetic ant hills" (because they face north and south), are located at Darwin (named for Charles); some mounds reach a height of 20 feet. The termites build the mounds to protect themselves from the heat of the sun.

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CRAWFORD HOLLING
LAKE OF THE WOODS, ONTARIO

Canada's lake country—including Lake of the Woods in Ontario—was the choice of zoology professor Crawford Holling, who is also director of the Institute of Animal Resource Ecology at the University of British Columbia. The lakes, on the border between the boreal forests of northern Canada and the southern deciduous forests, are all "fantastically beautiful," according to Holling. "They have a very mixed fauna and flora, which not only has interest to an ecologist, but also imparts a visual variety," he said. "And, above all, my memories are of a solitude which is becoming increasingly difficult to find."

Professor Holling fondly recalls one dry summer without provisions at Lake of the Woods. "We had received our food supplies by air, but that summer the danger of forest fires was especially severe, and all the planes of the provincial air service were busy. For about a month we had no incoming provisions at all, so we lived off the land. We had delightful meals of frogs, fish from the lake, partridge stuffed with winter fern, bullrush roots, blueberries, and blackberries. For recipes we relied upon a book describing edible foods of North America. Strangely enough, it was written by Alfred Kinsey, the man who later became famous for the Kinsey Report. Most of us forget that he started out as an entomologist and naturalist."

A. STARKER LEOPOLD
SIERRA MADRE, MEXICO

A. Starker Leopold has returned many times to the Sierra Madre in Mexico, which he first visited in the 1930s. Now a professor of zoology and forestry at the University of California, he notes: "The Barranca de Cobre Mountains were so isolated that visitors had not yet arrived to disturb the natural balance of lions, wolves, and deer. I remember the thrill of seeing a family of mountain lions. I had gone out looking for wild pigs one foggy morning and saw one female mountain lion and two cubs, almost fully grown, hunting. Once I caught a glimpse of a grizzly bear that jumped out of the mesa brush." Today Leopold laments the fact that the loggers and construction companies have all but demolished the delicate balance of nature there.

ALBERT SZENT-GYÖRGYI
WOODS HOLE, MASS.

"Woods Hole, Massachusetts, is the best place in the world, so I have no place to go," said Nobel Prize winner Albert Szent-Györgyi. "It's my favorite place and my favorite vacation spot." The Hungarian-born scientist, who received the Nobel Prize for medicine in 1937 and 1955, said he first visited Woods Hole's marine biology laboratory in 1927 while attending a clambake held for delegates to an international conference in Boston. Years later he remembered the clambake's giant lobsters. "In 1947 I became disillusioned with Stalin, left Hungary, and chose to go to Woods Hole," Szent-Györgyi recalls. "I didn't go there only for the lobsters, but I wouldn't have remembered the place just for the laboratory," he says. Now almost 80 years old, Szent-Györgyi spends his spare time sailing, swimming, fishing . . . and sampling the lobsters.

At right, C. S. Holling, relaxing with systems ecologist Ken Watt at Lake Kipawa.

IRVEN DEVORE
ANDROS ISLAND, BAHAMAS

Harvard anthropologist Irven DeVore gets away from it all at Andros Island in the Bahamas, where he enjoys the thrill of bonefishing. "I doubt if that means much to someone who doesn't fish," he said. According to DeVore, the bonefish put up a helluva fight and are excellent game fish—which means they don't taste very good.

PAUL SALTMAN
COPENHAGEN, DENMARK

Paul Saltman, professor of biology and vice-chancellor of academic affairs at the University of California, San Diego, first went to Copenhagen as a visiting professor. Since that time, 11 years ago, he's been back for several visits. "I enjoy the pace of life there, punctual and unfrantic," he said, racing off to a campus meeting. "I like to walk the streets and be a part of the city."

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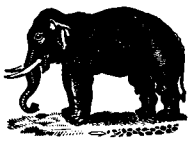


AFRICA

CONGO

CARL DJERASSI

"I visited Kruger National Park in South Africa in 1964," recalls Carl Djerassi, professor of chemistry at Stanford University. "I remember spending four hours in front of a large water hole," he said, "where hundreds of animals came to drink—antelopes, zebras, giraffes, and enormous elephants. Elephants, not lions, are the masters of the animal kingdom. It was a very biblical scene.

"I then went to East Africa, as I wanted to see the Ngorongoro Crater in Tanzania, which, I understand, has become quite a tourist attraction. The crater is 10 to 15 miles across, with thousands of animals wandering around the floor. I spent two days there, not as a hunter, but as a photographer. Observing nature in that context is very exciting, but perhaps too many people are going there now."

Last year, on a trip to Zaire (formerly the Democratic Republic of Congo), Dr. Djerassi suggested that a primate center be established there to study the area's pygmy chimpanzees. "We spent a week examining sites for such a center," he told us, "particularly in the upper Congo region. After flying to Zaire, we traveled by car, and then by boat at Lake Tumba. I stayed in a simple cottage by the lake and slept in the bed of King Leopold. It was rather primitive by Hilton Hotel standards, but the accommodations were nevertheless very comfortable."

N. TERENCE EDGAR

FRONT RANGES OF THE CANADIAN ROCKIES

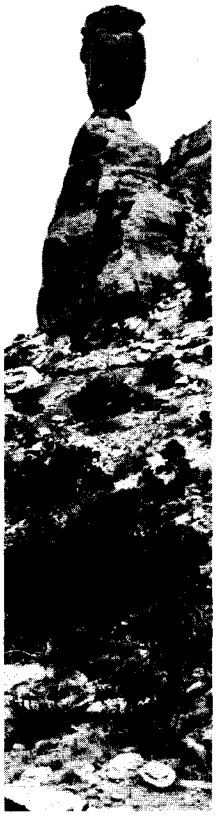
Geologist and oceanographer N. Terence Edgar, now at Scripps Institution of Oceanography, did his first professional field work at the front ranges of the Canadian Rockies, between Banff and Jasper national parks in Alberta. The area is filled with geological wonders, according to Edgar.

"My most vivid memory was finding high-altitude fossils of animals that once lived on coral reefs 350 or 375 million years ago," he said. "The idea of discovering oceanic, tropical life high in the Canadian mountains was something of a shock in those days. These mountains are essentially plains that have been crumpled, tipped on edge, and upthrust."

Dr. Edgar and his crew traveled by pack string. "Every three weeks we sent someone out on horseback for more food," he recalled. "The first week we ate pretty well; during the second we picked out what had not yet spoiled; the third week we ate the canned stuff. This routine was interrupted fairly regularly by the grizzlies, who preferred the fresh meat. We preferred to have happy, well-fed grizzlies around us rather than hungry, mean-tempered bears."

THOMAS POULSON

CHIRICAHUA NATIONAL MONUMENT, ARIZONA



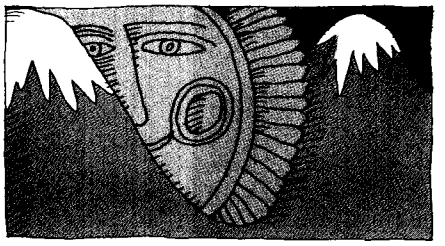
Thomas Poulson of Notre Dame University, a specialist in cave biology, chose Chiricahua National Monument in southeast Arizona, which he describes as "a hot spot for finding rare Mexican plants and animals. It is the only place in this country where trogons (tropical birds with brilliant plumage) live, and you may also see jaguarundis (long-tailed wildcats), coatis (raccoon-like mammals), ringtailed cats, and peccaries (nocturnal wild swine). There are 17 kinds of rattlesnakes and a generally rich reptile fauna."

Poulson said that the best way to see the area's geology is to follow the hiking trails up and down the hills or to rent a horse.

"In the past this area was very active volcanically," he said. "At some time, a big blowout of volcanic ash blanketed the whole region; differential wind erosion scoured and shaped the ash into fantastic columns and hollows. There are picture-book zonations of rock where layering has been exposed."

ROBERT JASTROW

PRESIDENTIAL RANGE, NEW HAMPSHIRE



Robert Jastrow, physicist and director of the Goddard Institute for Space Studies, has had a long association with New Hampshire's Presidential Range in the White Mountains.

"I've been going there since I was 16 years old," the 47-year-old physicist recalled. "I remember hiking down Mount Madison by myself in a heavy rainstorm. I was drenched to the skin. I felt that all the problems I had carried up there with me were washed away.

"Another time I was camping up at Star Lake with a few friends. We didn't have any tents, and we carried miners' lamps instead of flashlights. The miners' lamps got wet, and we stumbled about a half-mile in the pouring rain until we reached shelter. That also was a very scary, cleansing experience."

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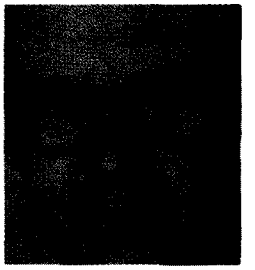
B. F. SKINNER



At 69, B. F. Skinner, Harvard professor and educator, is the controversial author of *Walden Two* (1948) and *Beyond Freedom and Dignity* (1971). He declined our invitation to name an unspoiled place. He said:

"If I did know of an unspoiled place it would be a great mistake to publish it in *Saturday Review*, would it not?"

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THE STONE MONUMENTS OF MENORCA

By Frederic V. Grunfeld

RELICS OF THE BRONZE AGE CONFOUND BOTH TOURISTS AND EXPERTS WHO VISIT THIS MEDITERRANEAN ISLAND.

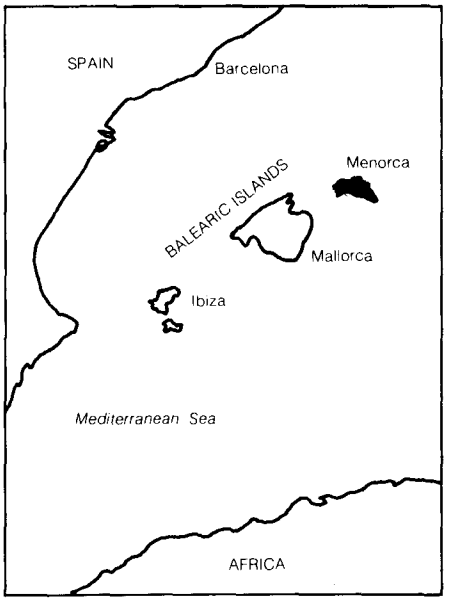
Menorca is an island of ancient stones and windswept hills, a mysterious place, visibly behind the times, and now one of the last survivors of that almost extinct species, the unspoiled Mediterranean island. This is where, even in the height of the summer tourist season (if you don't mind hiking through the fields for a mile or two), you can still find deserted beaches whose sands are not marked by even the print of a Friday foot. It is an island whose scenery can inspire you with a magnificent feeling of physical solitude—the sort of thing the Romantic poets used to cultivate, not the psychic loneliness derived from crowds. More than 120 beaches have been counted on Menorca, which is a great many for an island roughly 30 miles long by 12 miles wide. Though real estate developers have started nibbling away at some of them, there are still vast stretches where nobody ever bothers to go. Behind the beaches, the landscape is equally untouched, and the people in the interior go on living in a comfortably self-sufficient world of their own: that, after all, is what *island* ought to mean.

Not that I want to imply that nothing ever happens here. On the contrary, everything has happened here, but Menorca doesn't let on. This is where "Old Ironsides at her anchor lay/ In the harbor of Mahon"; where the Duc de Richelieu's cook discovered the recipe for mayonnaise sauce; where the Turks sacked the main towns and carried off the best-looking women; and where Lord Nelson is said to have dallied with Lady Hamilton, putting the good eye to the telescope for a change.

Both the British and French repeatedly invaded the island to establish naval bases here, before Menorca ceased to be strategic and became at best a merely tactical backwater. The more recent invaders have been electricity and asphalt, along with plastics, bikinis, and that great enemy of oral tradition, the transistor radio. Even so, the eighteenth century has not yet capitulated to the twentieth. I can think of no better proof of this than the fact that young girls do not leave the farms to become hotel waitresses—they stay home to help their parents milk the cows and whitewash the house. It used to be a Menorcan custom to whitewash the house every Saturday morning, but now, under the pressures of modern life, they whitewash only once every other week. Clearly, the fabric of society is unraveling. When they plow their fields, the peasants still serenade their mules with the nasal old folk songs that come to a pause with a melismatic flourish at the end of every furrow. There's a Menorcan saying, *"Es parei no esquieixa mai, si a darrera es manti i ha una bona veu"*—"The team never tires when there's a good voice behind the plow." And if you are very lucky or persistent, you can still hear shepherds play their shrill flutes and pan-pipes *(bufa-cañas)* on the slopes of Monte Toro, the highest peak on the island, which looks out over everything else from 1,000 feet above sea level.

Menorca has no museums worth mentioning, but the whole island is an open-air exhibit of Bronze Age culture. No other spot in the Mediterranean is so thickly strewn with megalithic monuments. In literally hundreds of places, you come across ruins of the earliest buildings in Europe, the so-called *talayots*, which look like stone igloos built by a race of giants. A dusty side road will sometimes lead to a miniature version of Stonehenge—a circle of stone slabs dominated by an immense T-shaped *taula*, which looks like a table made for a Titan. To call them sacrificial altars, as has been proposed, conjures up visions of virgins. But the evidence of the bones strewn in the vicinity suggests that the victims—if there were any—were mainly cattle.

Since the Bronze-Age Menorcans left no written records, archaeologists can



Imposing stone structures–a talayot *(above) and a* taula*–still preside over this tiny Mediterranean island.*

Frederic V. Grunfeld, a roving editor of Horizon, *lives in Mallorca.*

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only speculate about the actual use of *taulas*, or, for that matter, the means the builders used to balance a giant horizontal slab atop a 16-foot vertical one so solidly that, in some cases, 3,000 years of storms and earthquakes have been unable to dislodge them. One authority has suggested that the *taulas* might have been intended for preburial dessication of bodies, rather like the Parsee "towers of silence" in India. Or perhaps the *taulas*, with their surrounding circles of stone, were sites for sun or moon worship. Other experts have proposed a more imaginative hypothesis: if not altars, then perhaps the *taulas* were themselves stylized images of a sacred bull, and thus objects of worship, with the horizontal slab representing the bull's head. This strikes me as the most elegant explanation, the one that satisfies my own feelings about these enigmatic structures, which seem more like sculpture than architecture.

The *taulas* and *talayots* are scattered in the fields and pastures, mostly in the southern half of the island, well away from the *tramuntana* wind that howls down from the Pyrenees during the winter. No one has thought about fencing them in or turning them into formal public monuments. Instead, they stand, as they have for 3,000 years, surrounded by wild olive bushes and an aura of mystery. At night, when all is still and only the distant barking of dogs disturbs the darkness, the circle surrounding a *taula* is an eerie place, suffused with slightly sinister vibrations, and one can't help wondering what sort of fertility rites might have accompanied the worship of the sacred bull. In the daytime, however, everything looks much more homelike and bucolic, the cows cheerfully ruminating among the *taulas* and *talayots*.

No one is quite certain, either, whether the 500 *talayots* on Menorca (or similar structures on Mallorca and Sardinia) were meant to be dwelling places for the living or tombs for the dead. Perhaps the most remarkable clue of all is that present-day Menorcan farmers still build almost identical structures of fieldstone, rather like domed pyramids, which serve as shelters for goats. Known as *barracas*, they have the advantage of needing neither beams nor mortar and of being impervious to both water and termites; at the same time they are the best method yet devised for getting rid of all the loose stone that would otherwise clutter up the fields.

Besides the megaliths, there are countless caves left to be explored. The coasts are riddled with them, and many show signs of having been inhabited. Once I came to an isolated cape near the fishing village of Fornells, where sheep were grazing in a ravine full of red Bronze Age potsherds. In a nearby cave I found a dozen skulls neatly lined up on a stone shelf, awaiting other visitors.

While walking in Menorca, you stumble on relics of subsequent epochs, as if you were visiting a layer cake of history. The Phoenician traders who came here from Tyre and Sidon were Menorca's first contact with a more sophisticated civilization. The Phoenicians called it "Nura"—i.e., Fire Island. To the Greeks, in turn, it was "Meloussa," or Cattle Island. But the Carthaginians, first to take over the island by military occupation, named its great port "Maghen," meaning "protection" or "a haven"—and Mahon it remains to this day.

The earliest classical writers on Menorca and the other Balearic Islands mention that the original inhabitants went naked in the summer. (Now it is the "hippies" from the yachts who walk nude on outlying beaches. The natives, responding to their bishop's stern warnings, wear decent, one-piece bathing suits if they go swimming at all.) The early Balearic natives were reputed to be superb marksmen with a slingshot. When the Romans drove out the Carthaginians, they took the sharpshooters into their armies and formed units of Balearic slingers, employed very much like machine-gun regiments.

The Roman "Balearis Minor," after countless attacks by the Vandals and Byzantines, was then overtaken by the Moors, who ruled the island for several hundred years, calling it "Minurka." In the thirteenth century a Christian reconquest was led by the king of Aragon. But for centuries afterward Menorca was plagued by sudden Islamic invasions, both by Barbary Coast pirates and the Turkish fleet. Favorite targets were the women on isolated farms, who could be grabbed and bundled aboard ship before help arrived; the last woman to be carried off in this fashion was kidnapped in the 1830s.

Getting There . . .

Unless you like slow trips on small boats, we advise you to fly to the town of Mahon on Menorca. It's only a half-hour flight from the sister island of Mallorca, with regular service from Iberia and Aviaco Airlines. You can fly to Palma de Mallorca from London with British European Airlines, Iberia, and others. You might spend a day or two taking in the sights of Mallorca, notably the great golden cathedral and the corniche road along the north coast, before hopping islands to Menorca. If you're in Spain, travel to Mahon from Barcelona (daily flights) or Madrid, again on Iberia and Aviaco. From New York, Pan Am, TWA, and many other carriers fly directly to London, Barcelona, or Madrid.

THE MONUMENTS STAND, AS THEY HAVE FOR MORE THAN 3,000 YEARS, SURROUNDED BY WILD OLIVE BUSHES AND AN AURA OF MYSTERY.

Meanwhile, Menorca—like Gibralter—was captured from the Spanish by the British in the 1700s, inaugurating a century of occupation, broken only by two short periods of French rule. For failing to recapture Menorca during the Seven Years' War, the British Admiral Byng was court-martialed and shot —"to encourage the others," in Voltaire's memorable phrase. What everyone coveted, in that age of naval aggrandizement, was the harbor of Mahon, the finest in the Mediterranean. "In the most tempestuous weather," explained Louis XIV's advisor, Cardinal de Retz, "it is as calm as a basin, and as smooth as a piece of ice."

Though Menorca was finally returned to the Spanish crown in 1802, memories of the British era still linger. The Menorquin language—a gnarled branch of Catalan—contains a sprinkling of English words and phrases, often with completely altered meanings (when a boy shouts, "Please!" during a game of marbles, he means, "Get out of my way"). One of the local folk dances is a Mediterranean version of the Highland fling, once introduced by Scottish regiments. Both Mahon and the village of Villa Carlos (formerly Georgetown) maintain small Methodist churches for the descendants of British grenadiers who settled here in the eighteenth century. Many of the older houses have sash windows instead of casements, and one of the showplaces of Mahon is the Georgian hilltop mansion where Nelson stayed. Menorca's oldest distillery advertises its Old English Dry Gin as having been "founded during English occupation."

The sister Balearic Islands of Mallorca and Ibiza (of Clifford Irving fame) have long since become the Miami Beaches of Europe, with tourists all but blotting out the sun. Somehow by dint of a certain erratic independence, Menorca, with its 45,000 people, has managed to survive these incursions as it once managed to survive the Turks. For a while it seemed as though the bulldozers might have their way, but now the conservationist cause has gained the upper hand even in this remote corner of the world. There seems to be a real chance that it can continue as "the last Mediterranean island." □

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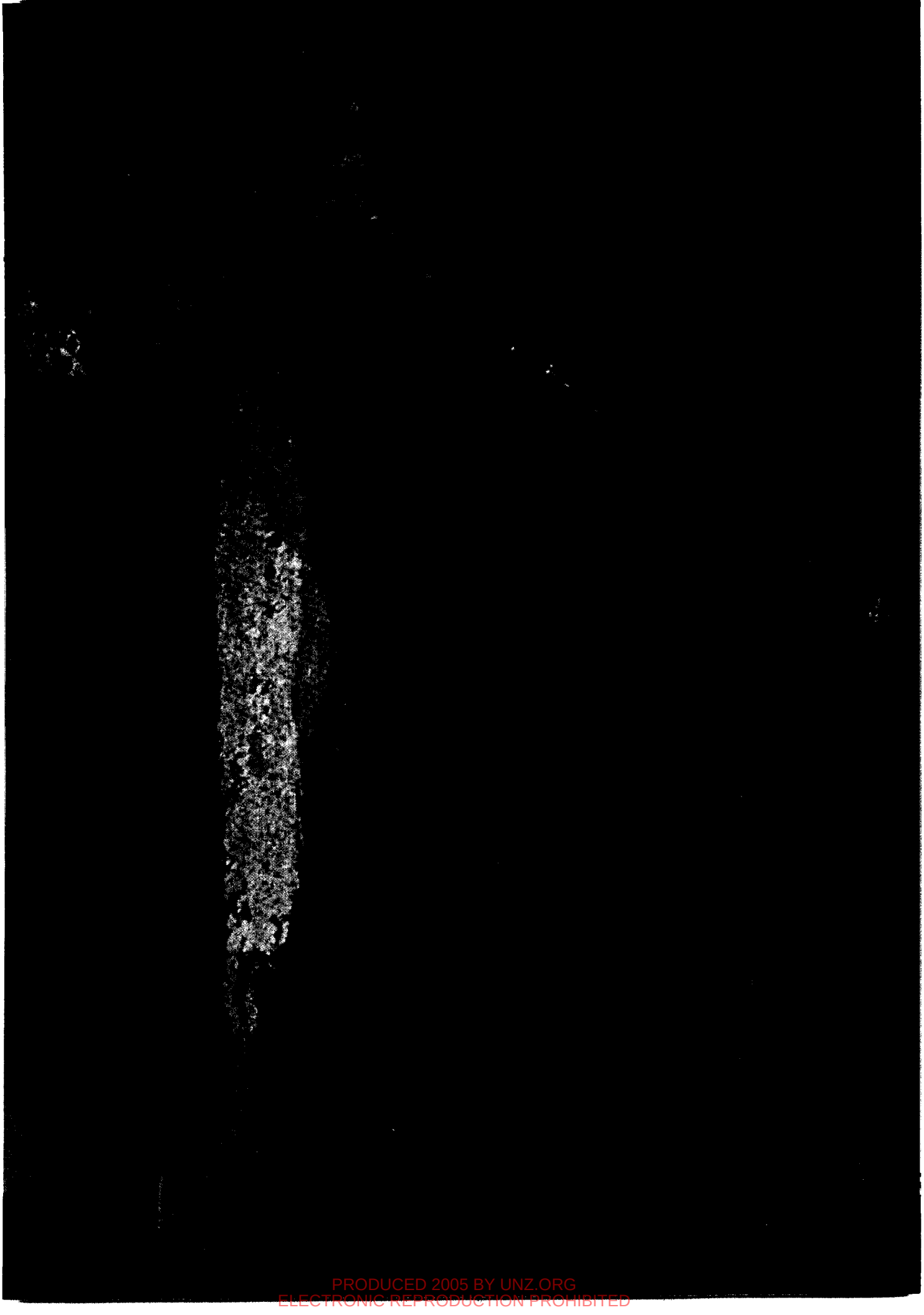

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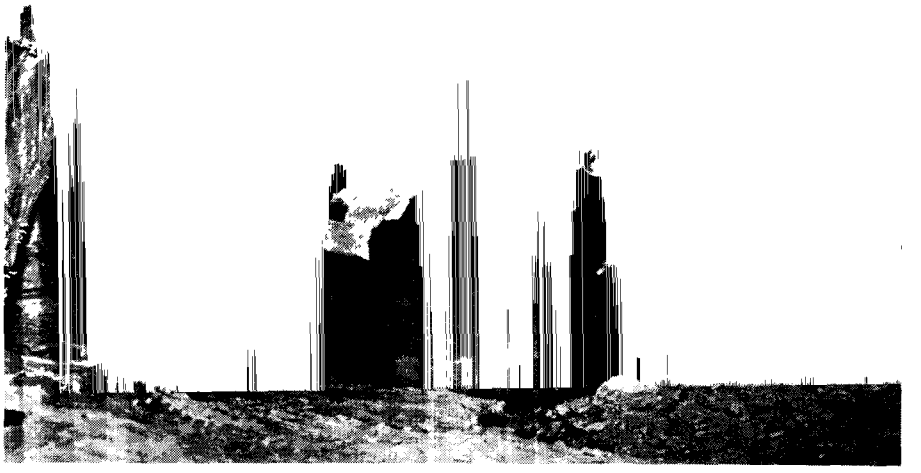


DISCOVERING THE WORLD'S BIGGEST CAVE

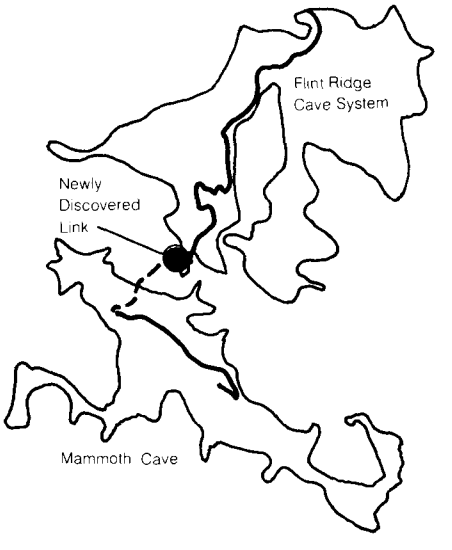
By Patricia Crowther

FINDING THE MISSING LINK TO MAMMOTH CAVE WAS LIKE CLIMBING MOUNT EVEREST—UNDERGROUND

I was underground for part of the Memorial Day weekend of 1972—deep inside the catacombs of Kentucky's Flint Ridge Cave System. While thousands of holiday visitors walked along well-marked routes in other areas of the caves, I was lying on my back in the mud, 380 feet underground, trying to dig past a rock pile. I was searching for a new passageway that I hoped would connect the Mammoth and Flint Ridge cave systems.

I slipped forward in the mud; my shoulder jammed between two rocks. I tried to move back, but I couldn't use my arms. Claustrophobia had never been a problem for me, or I would not have become a cave explorer; nonetheless, panic began to set in. About eight hours' crawling and walking lay between me and the outside world. Rapid breathing was making me dizzy. "I'll never do anything like this again," I muttered through chattering teeth. When my breathing returned to normal, I squirmed backward, snake-fashion, by wriggling my whole body. I crawled out of the dead end and, with my feet in the underground stream, sat for a long time on the mud bank, shaking with adrenaline reaction.

I had hoped that the day's exploration might show us the elusive passage from Flint Ridge to Mammoth. But many people doubted that such a passage could exist, since the limestone ridges containing the two giant cave systems are separated by a valley 200 feet deep. This valley was thought to have removed the "roof" of sandstone that protects cave passages elsewhere from erosion by water from above. Discovery of a connecting passageway would be a very dramatic development in speleology (the science of caves). The Flint Ridge system, with some 87 miles of surveyed tunnels, was already the world's largest cave, and Mammoth, with 58 miles of known passages, was third largest. Discovery of a connection would show the complex to be one continuous labyrinth about twice as extensive as the world's second largest, the 72-mile Holloch Holle in Switzerland.



When my shaking had stopped, I began the four-mile trek toward the Austin Entrance with the three other members of my team. We passed survey markers at least every 50 feet—pea-sized black dots smoked onto the rock by our carbide miners' lamps. Instruments used in our survey of the caves included a 50-foot steel tape measure (it is rarely possible to see more than 50 feet along a passage) and a folding compass with eye sights. The sights on the compass allowed us to "shoot" the bearing, distance, and vertical angle between survey stations. We also noted passage dimensions and special features in a field notebook. Later each survey station was plotted on a computer-drawn map of the cave, and details were added by hand. The Cave Research Foundation (CRF) and the National Park Service have cooperated in such surveying since 1959.

Mammoth Cave was called one of the seven natural wonders of the world as long ago as 1847, and in 1941 it became the nation's twenty-sixth national park. The entrance to Mammoth appears to have been found by a hunter named Houtchins, who was pursuing a wounded bear in 1809. The caves began to receive national attention with the death of the famed explorer Floyd Collins in a caving accident in 1925.

My own cave research began during my undergraduate days at MIT. I met my husband underground in a cave in New York; Will and I spent our honeymoon exploring the confusing labyrinths of Breathing Cave in Virginia. When

Patricia Crowther graduated in physics from MIT *and worked there for four years as a radio astronomer. She and her husband are currently chief cartographers for the Cave Research Foundation.*

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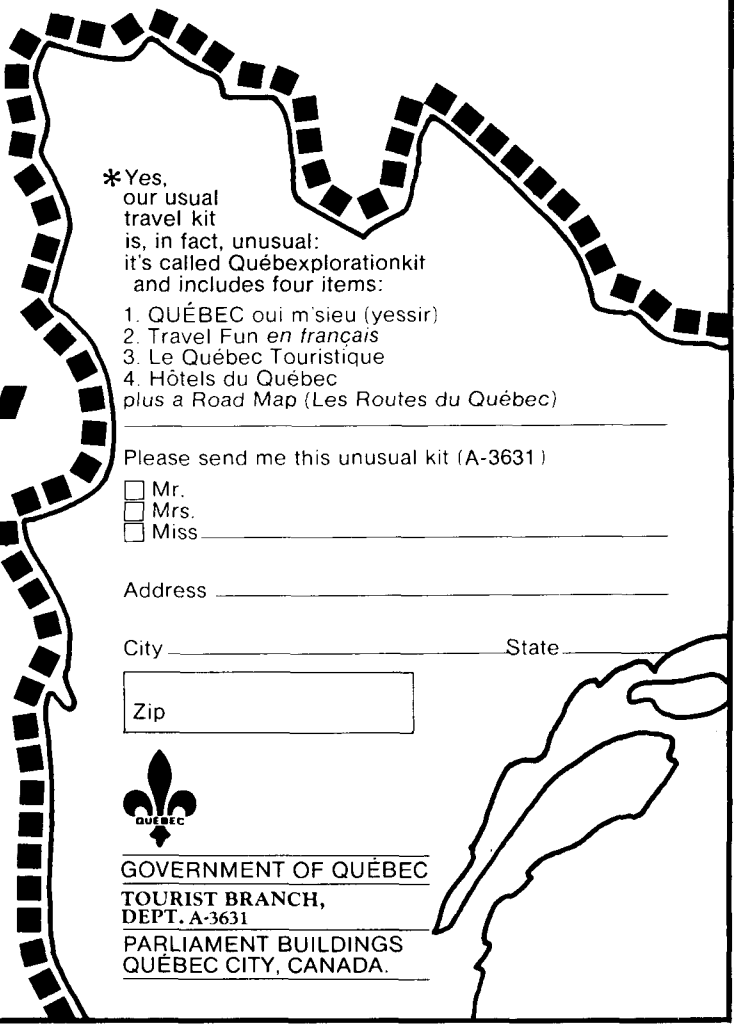

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In Hanson's Lost River, which varied from knee deep to neck deep, the explorers found the marking "Pete H." Since Pete Hanson was a Mammoth Cave guide, they knew they had found the connection to Mammoth.

friends recruited us for field trips in Mammoth Cave National Park in 1969, we eagerly locked our house and headed southwest.

When we first arrived at the Cave Research Foundation headquarters in the park, we met cave explorers from throughout the country—an archaeologist from St. Louis, a laser scientist from New Mexico, an advertising man from Ohio. Most of them were interested in mapping cave passages, some traced underground streams, some counted cave crickets (200 species of animals live in the Kentucky caves).

Underground, the caves met all our expectations, featuring subterranean galleries sometimes more than 100 feet wide and high. We navigated a bewildering succession of caverns, low crawlways, deep canyons, and streams —more changes of direction than I could remember. The vastness and intricacy of the maze numbed my brain; yet both Will and I could feel our curiosity grow. Where did all those passages go? Could we ever find the needle in the haystack, the one passage in thousands that might connect the Flint Ridge and Mammoth Cave systems?

Fortunately, as we became more involved with CRF, we were able to offer some specialized help in tracing the maze, because we both work with computers. Our home literally became a map factory, filled with survey books, maps, and computer printouts. A corner of the living room held a computer terminal. As it turned out, we were able to "teach" the computer to plot survey maps. We could never otherwise have dealt with the flood of data gathered in 30 miles of passages during a three-year surveying program.

The real thrill, however, came from caving itself. Even though we had stopped at a rock pile on Memorial Day weekend, I itched to return to Flint Ridge. In July I got my chance. Will thought the passage we had tried was hopeless, but I returned to it anyway. We worked our way backward from the rock pile, checking every tiny hole leading off to the side. After a few anxious moments in one tight virgin crawlway, I found a pretty, symmetrical dome 10 feet across and 15 feet high with a circular pool exactly in its center. Dripping water fell from a three-inch hole on the wall. It was the first time I had been able to stand up for a long time. I find that I get a lot of pleasure from squeezing into a tiny hole where nobody has been before and discovering something beautiful. My side lead ended here, however.

After two hours, only 1,600 feet back from the rock pile, we were following a side passage, a belly crawl in muddy water, to its end. While one of the others tried to move a rock that was firmly wedged across the end of the passage, I slipped down to the left to a crevice less than a foot high and found a new passage, 100 feet of almost dry crawl space that led to a little pit, where loud rushing water noises came out of a small canyon in the floor. I followed the canyon until it was less than eight inches wide, then climbed up and wriggled on my side through a slight widening at the ceiling. The walls opened out again above a stream leading to a ten-foot waterfall in a large room. A small drain appeared to head west out the bottom. Because no one knew where I was, I didn't try to climb down; but I knew I had a real, live, going lead. The trip was worth it after all.

A month later, in August, an exploration team went straight to my little drain lead. They surveyed to where I had stopped; then Tom Brucker explored the drain while Richard Zopf coiled the measuring tape, preparing to head back. Tom is a six-foot 19-year-old who first entered Mammoth Cave at the age of three months; since then he has virtually memorized the Mammoth Cave map. Going past the spot that had stopped me, he pressed on to a strange river and followed it for 1,200 feet, first on all fours and then on foot in an eight-foot-high tunnel that housed cave blindfish and crayfish. The river was a major discovery—even though Tom had left the compass with Zopf and did not know in which direction the river ran.

On August 30 I was at Flint Ridge again, excited by the possibility that this new river might lead to Mammoth Cave. We wondered who would be chosen to go there. Expedition leader John Wilcox, a raw-boned mechanical engineer from Columbus, Ohio, said, "By the way, Pat, you're leading this party." In CRF the party leader's word is law, so I out-ranked John Wilcox as well as Tom Brucker and Richard Zopf. This policy makes decisions perfectly clear and passes around the fun of leadership. It was highly satisfying for me to lead, to know that I was responsible for the choices I made.

We set off in high spirits, singing the "Tight Tube Blues" badly offkey and doing the "Bretz River Shuffle"—named after a particularly narrow stretch of tunnel where you have to walk sideways. We started our survey through the drain, turning right at the river. We slogged downstream, stoop-walking through pools with gravel sandbars, on and on. As leader, I watched the time, knowing that a rescue team would automatically be sent down if we were four hours late in returning.

Tom Brucker's initials in the mudbank marked his farthest penetration along the river, and we moved past them through virgin cave. We sloshed ahead on hands and knees in shallow water, getting wetter and colder. Then Tom and Richard were yelling up ahead —what for? When I came up to them, they were in a small room, pointing at a mudbank. There, clearly revealed in the yellow glow of the carbide lamp, was an arrow scratched in a mudbank, pointing downstream, the direction we were headed. On another wall we saw faint letters, which we deciphered as reading PETE H. Pete H. was telling us that he had come from the direction we were heading. Mammoth at last? We had seen arrows like this in Mammoth itself! They belonged to Pete Hanson, a Mammoth Cave guide and a leader on the trip that found the New Discovery section of Mammoth Cave in 1938. The letters were probably 34 years old.

We whooped for joy, for we knew that at last we had connected with Mammoth Cave. No doubt this was Pete's farthest penetration. But where were we exactly? I set a one-hour time limit, and we followed the stream at a brisk pace; it swelled and turned south, diving right under passages in Mammoth Cave. We trudged in bent-over fashion, thigh-deep in water, our backs aching. We kept walking. After a mile we could stand up briefly. The passage continued, but we

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were out of time and our energy reserves were drained. We left our own initials on a wall, still not knowing where in Mammoth we were, then shifted our minds into automatic for the five-mile return trip. Tom said the cave was spinning around him. John's elbows were rubbed raw. I had a sore knee and hip. Richard was the only one still in one piece. Finally, after 21 hours underground, we came out of Flint Ridge just as the bats were flying in for the day. The golden sunrise lit our faces.

We experienced an indescribable feeling, having entered Mammoth Cave from Flint Ridge for the first time —something like having a baby. You had to keep reminding yourself that it was real, this new creature you have brought into the world that wasn't here yesterday—the Flint Mammoth Cave System. Everything else seemed new, too. After I woke up that afternoon, I listened to a Gordon Lightfoot record. The music was so beautiful it made me cry.

On September 9 I returned to Flint Ridge. I was needed at home, but Will jumped to the rescue; he understood how important this netherworldly connection was to me and was willing to prepare our two daughters for the opening of school. At the cave Wilcox had summoned a group of strong, thin cavers; Steve Wells, who is working on a master's degree in geology; Gary Eller, research chemist and CRF manager for Mammoth Cave operations; Cleve Pinnix, Park Service ranger; and Richard Zopf, carpenter and craftsman.

John took no chances. We had four compasses and two survey tapes, as well as candy bars, tinned meat, and cans of fruit. He set up a leapfrog survey from the last station near PETE H. and the arrow. Three of us surveyed 30 stations, then passed the other party, and resumed the next survey. All went smoothly, hour after hour. At the end of our second survey jump, we came upon the other party, 600 feet from where we had left our initials on the previous trip. They had had the hardest part of the survey and were ready to quit for the day. We waded on to the initials, then proceeded to unfamiliar cave. After 450 feet the mud-covered ceiling dipped lower and lower. Soon we were walking in a tunnel with three feet of water and a four-foot ceiling. We tried not to make waves, since there was only a foot of space for our heads.

Wilcox is in front. "The ceiling is rising. I see a tourist trail!" he says. We are yelling now. Zopf sticks on a projection. We push him hard and shove him through. We sink chest-deep in water, lay our ears next to the water, and float out into a black vault, which looks like a moonless, starless night. On the far shore we see the linear outlines of a steel pipe railing atop a man-made rock walkway. I feel weirdly disoriented, seeing this artificial construction in the far reaches of the wild Flint Ridge Cave System. Where are we? Intellect screams, *Mammoth Cave!* Instinct shouts, *Not possible!* The wading is easy, but I slip on an underwater rock and sit in the water up to my neck, soaking a third compass. Finally we all recognize where we are—Cascade Hall near Echo River, where the boat landing used to be. Although tours no longer go this way, millions of Mammoth Cave visitors have passed by the little hole we came through. We plunge back into the water and complete our survey of the new connection, so we can tie it into an earlier survey CRF had made in Mammoth Cave's Cascade Hall. We joke about "driving the golden spike."

Soberly we contemplated the tough eight-hour return trip, but with a grin Ranger Pinnix fished into his pack and produced the key to the locked entrance of Mammoth Cave. We left Mammoth Cave early in the morning of September 10 by way of the elevator in Snowball Dining Room, thus completing the first portal-to-portal trip into Flint Ridge and out of Mammoth Cave. Even soaked to the skin and with mud on our faces, none of us could stop smiling, for we had just "climbed the Everest" of speleology. We posed for a souvenir photo and later relived the 16-hour trip in the Pinnix living room over a bottle of long-saved champagne.

When I got home later that day, it was good to be with Will again, for there was much to tell. We talked nonstop until midnight, when he went to bed and I sat down at the teletype to tell the computer about our surveys. The plotter drew the map for me—*then* I could sleep, knowing that the new Flint Mammoth Cave System is the most extensive in the world, with more than 144.4 miles of surveyed passages.

We returned to the caves in December and realized how lucky our timing had been: the passages we had discovered at the end of the dry summer were now flooded. We also realized there may be more cave to discover. Flint Ridge and Mammoth Cave Ridge have a sister named Joppa, also partly hollow with extensive tunnels. If a connection to Joppa is found, and if we can find ways into the unexplored sections of the three ridges, Kentucky's continuous supercave could prove to be as long as 300 miles. □

Muddy but exuberant after discovering the connection to Mammoth Cave are, back row from left: John Wilcox, Richard Zopf, Steve Wells, and Cleve Pinnix; front row: Gary Eller and Patricia Crowther.

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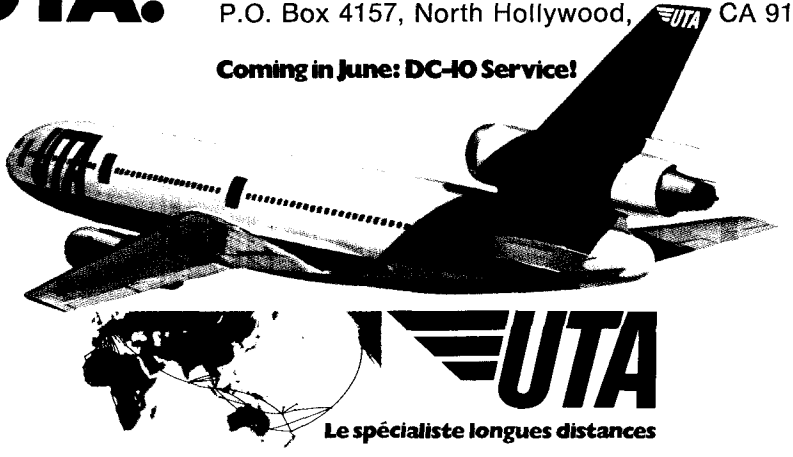

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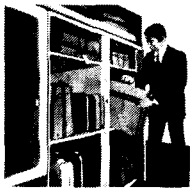

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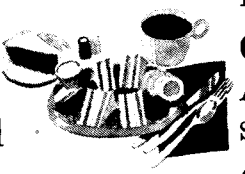

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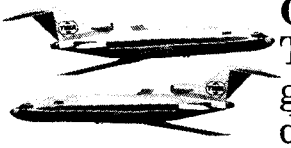

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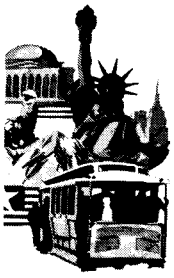

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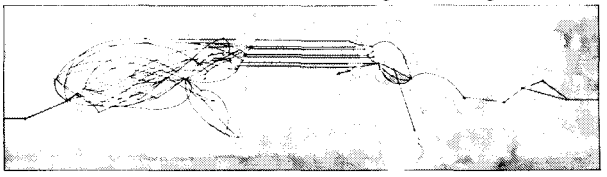

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ISLANDS OF LOVE
THE SEYCHELLES

By Christine Hoover

PARADISE BECKONS ON THESE ISLANDS—IF YOU KNOW WHERE TO LOOK.

Twenty jumbo jets a week slap down on the new sea-lapped runway. International concerns are building high-rise hotels on the choicest sweeps of beach. Yachts arrive daily from ports all over the globe to offer charter and fishing services. An outer island is for sale for one million dollars. This is Seychelles—once a "forgotten Eden," now a crossroads in the Indian Ocean and site of the newest and hottest boom in island tourism.

The Seychelles Islands popped onto international travel schedules in March 1972, when Queen Elizabeth II officially opened an airport on the island of Mahé. Before that, the islands were almost totally isolated. Originally settled by the French in the 1770s, the islands were ceded to the British in 1814, and in 1903 they became a Crown Colony.

The transition from a simple fishing society to a first-class resort does not happen at the drop of a coconut. To accommodate the growing number of tourists, David Joubert, the minister of social services, says, "the master plan calls for 500 beds a year until 1975, when we estimate the islands will lodge 30,000 visitors yearly." But, he stresses, "development must not get out of hand. No charter airline will be allowed to land without confirmed reservations for all passengers, and no hotels will be built higher than a coconut tree."

The Seychelles are unusual, as tropical islands go. The archipelago contains some relatively rare granitic islands. Steep slopes rise abruptly from the sea to altitudes of 2,000 to 3,000 feet. Towering cliffs are interspersed with giant palm forests, and at any cove, or *anse*, large boulders resembling brown velvet cushions provide resting spots for rare seabirds. On several islands there are giant tortoises indigenous to the Seychelles, and Silhouette Island claims the only virgin forest in the Indian Ocean. It is not surprising that tourists want to capture such exceptional beauty before it succumbs totally to development.

The main island of Mahé (pronounced *ma-hey*) offers the vacationer the full range of sports, including game fishing with catches to challenge the world records, goggling (snorkeling), and scuba diving above spectacular reefs, as well as more than 70 miles of tarmac road for excursions to tea plantations and remote, talcum-white beaches. Mahé is also proud to claim the capital, port, and only town in the 91 islands—Victoria, sheltered under the watch of Les Trois Frères mountains. But Mahé is already having its problems. Covering an area of 55 square miles, very little of which is flat ground, the island supports 50,000 people, most of whom live near Victoria. With the influx of tourists, the roads are becoming crowded with minicars, and the once pure waters are in danger of pollution. The tourist soon finds he must escape to an outer island to capture the glimpse of paradise he sought in the Seychelles.

The most popular trip is to Praslin *(prah-line)*, the second largest island and home of the giant "coco-de-mer" bi-lobed coconuts. The crossing from Mahé by local steamer takes between three and four hours, depending on the temperament of the sea. After a Creole lunch of shellfish or *tec-tec* soup and curried *cordonnier* (red snapper), you will be transported to the Vallee de Mai, believed by one nineteenth-century British explorer to be the original Garden of Eden. Walking through this damp, primeval forest, you will see the remarkable "coco-de-mer" palms with fruit often weighing more than 100 pounds and reputed to be a powerful aphrodisiac. While there is no evidence to support the theory of coconut power, the local claims—and questionable tales of amorous islanders—have contributed to the reputation of the Seychelles as the "islands of love."

Across a narrow channel from Praslin is La Digue, a far more primitive island. On La Digue broad-shouldered oxen labor to pull carts of tourists over potholed paths; they also circle endlessly to grind copra (dried coconut meat) into oil for soap and shampoo. But separation from the mechanical world frees your senses for the undisturbed nature around you. You can pull a leaf off a tree, crush it in your hand, and take in the pungent smell of cinnamon. If you are lucky, you can spot the black paradise flycatcher with its swooping, long tail, darting among bushes heavy with vanilla beans.

Perhaps the most exceptional of nearby islands is Cousin *(coo-zan)*, a bird sanctuary privately owned by the British Section of the International Council for Bird Preservation. As you walk along trails cut through the woods, you see a never-ending supply of white fairy terns laying eggs on seemingly precarious branches of casuarina trees without nests. Following the paths up to the granite rocks, you may see the beautiful, large white-tailed tropicbird, as well as

Christine Hoover is a freelance writer (and former travel agent).

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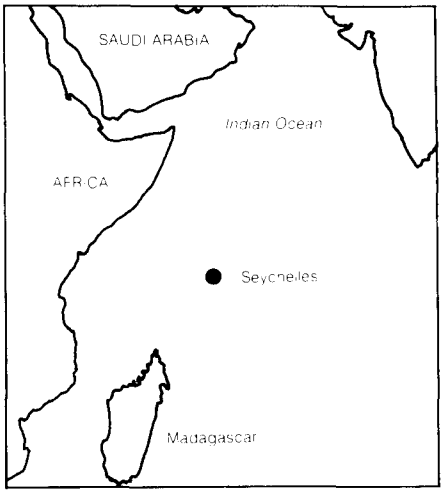
giant tortoises. You must take care not to step on shiny skinks, emerald-green geckos, or harmless giant millipedes.

Back on Mahé, the life of the Seychelles is changing rapidly. Most of the Creole traditions, such as the casting of spells and the sensuous *moutia* dance, are passing away. Young people are no longer forced to emigrate for contact with the modern world—they can find jobs in hotels and tourist agencies right at home. Construction of the airstrip introduced many Seychellois to employment that was neither farming nor fishing. Scheduled for the near future are low-cost housing programs, a technical college, and the introduction of family planning (the birth rate is a high 32 per thousand, compared with 17 per thousand in the United States).

Britain's building of the $12 million airport was itself an act of compensation and self-protection. With its decreasing control over the port facilities in Hong Kong and Singapore and the closing of the Suez Canal, Britain has felt it necessary to strengthen its remaining possessions. In 1965 Britain appropriated three coral atolls belonging to the Seychelles, plus the Chagos Archipelago, to form the British Indian Ocean Territory (BIOT). To be jointly developed with the United States for defense and communication facilities, the territory provides excellent natural harbors in a location of strategic importance to the great naval powers—roughly halfway between Africa and India. The new civilian airport on Mahé, built in exchange for the three islands, could be converted to military use if needed.

The islands' status as a British colony has caused distress to some Seychellois. In an interview, Karl St. Ange, M. P. from La Digue and member of the opposition Seychelles People's United Party (SPUP), complained of a lack of self-determination. "While our local government has power over the internal policies of the islands," he said, "foreign relations and the purse strings are controlled from London. Until we are independent, we will not be able to receive direct aid from any country. We need as much technical assistance, scholarships, and grants as we can get now that we are developing. We must have freedom of choice."

SPUP is not for cutting all ties with Britain. Party members want Seychelles to stay in the British Commonwealth but on an independent basis. They are pressing the United Kingdom for a referendum through the United Nations and are receiving political support from the Organization of African Unity.



Mahé's main street: one of the less exotic places in the Seychelles.

In time, independence will most likely occur. For now, however, the controlling Seychelles Democratic Party (SDP), under the leadership of James Mancham, does not want to act too rapidly. Mancham believes that Seychelles needs time to develop a strong national identity, inhibited so far by the islands' diversity of ethnic stock and dependence on external economic support. When the economy is more self-sufficient and when islanders have the feeling of "Harambee" (an expression popular in Kenya, meaning, "Let's all pull together"), then independence will be practical, Mancham says. But for now, Seychelles needs the money Britain is pouring in for social and industrial development, as well as tourism.

The British government's avowed opinion is that independence is not the key issue. Britain is not struggling to hold onto the islands but would like to see them through until they are self-supporting. At present, financing comes almost entirely from British Colonial Development and Welfare Funds, which adds to the drain on Britain's economy.

For the tourist, the Seychelles are expensive, and prices are continually rising because of costly imports and profiteering. Most hotels require full board, ranging from $20 to $30 a day per person, double occupancy. Since most imports arrive by ship, there are delays and often spoilage of food on the docks because of the high humidity. Hotels are forced to pay high prices, and they pass the expense on to their guests.

Despite the current inflation, the Seychelles' chances for success as a tourist destination are excellent. They are coming to be considered as an extension of East Africa's game parks. After a two-week safari it is only three hours by jet and a few extra dollars from Nairobi for a week's relaxation in the Seychelles. The islands are also on a round-the-world routing from Tokyo to London, allowing business travelers a pleasant stopover. Due to their remoteness and the relatively high cost of air fare, they are unlikely to become a haven for American tourists, but they have proved popular indeed among vacationers on package tours from the United Kingdom, Kenya, and South Africa.

At present, hotel service is poor to mediocre due to untrained staffs, and menus are limited due to reliance on imports. Although steps are being taken to improve things, the Seychelles are still primarily for the adventurous tourist.

Will success spoil the Seychelles? Most likely, yes—at least the island of Mahé. The physical beauty will surely be bruised by Hiltonesque hotels. Yet, even if Mahé becomes another Rhodes or Palma, the sun will continue to provide its delightful tan, the sunsets will remain as vivid as ever. And the outer islands will continue to fascinate. It is reassuring to know that even excluding Mahé, there are 90 Seychelles islands that still offer paradise. □

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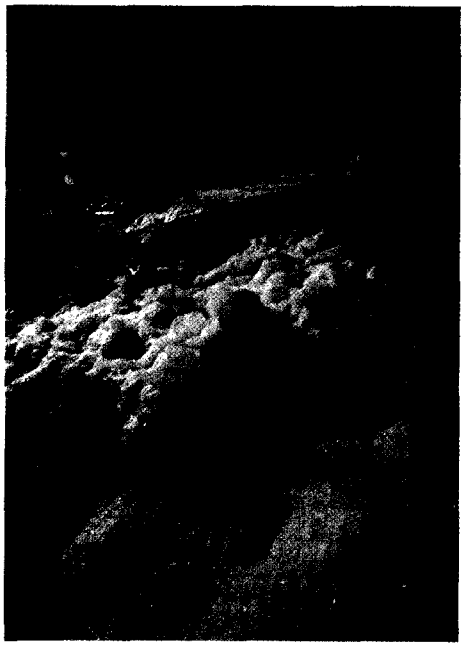
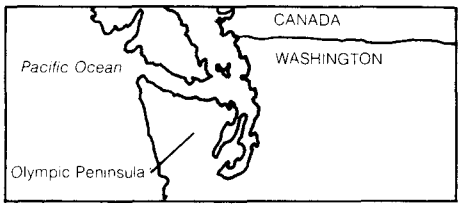
RAIN COUNTRY

Puget Sound and the Strait of Juan de Fuca take a notch from the far northwest corner of the nation, isolating the Olympic Peninsula. This is the land of the rain forest. Salt water surrounds it, mountains tower over it, but spruce, hemlock, cedar, and lush, green undergrowth dominate this land.

Once in the forest, you find yourself walking on windfalls and matted undergrowth—sword ferns, salmonberry, oxalis, a thousand different plants, brought forth by an incredible 140 inches of rain each year.

It's a place of intriguing names: Queets River, Sol Duc Springs, Dosewallips, and Hurricane Ridge. Anthropologists come here to reconstruct old Indian cultures. Geologists roam one of the world's youngest mountain ranges. Tidal pools call forth marine biologists, and botanists discover rare alpine flowers.





"All of this can be sampled in a day or two by car," says Ruth Kirk, author of *Exploring the Olympic Peninsula*. "But to *know* this peninsula takes a car, a truck, a horse, a boat, skis, climbing boots, an airplane—and a lifetime." □

Information about the Olympic National Park can be obtained from the Park Superintendent, 600 Park Avenue, Port Angeles, Washington 98362.

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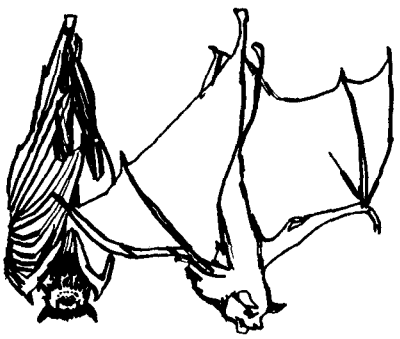
LIFE SCIENCES

Bats and Epilepsy

For eight years researchers at the University of Michigan and Temple University have been trying to learn how certain mammals go into hibernation—drastically slowing their body functions and lowering body temperature to near freezing. One unexpected result is that the brain-wave pattern of hibernating bats is "strikingly similar" to that of humans with *petit mal* epilepsy. Another similarity, according to Michigan's James Koski is that the blood level of bromide salts drops sharply in bats just before hibernation; bromide salts are also used to alleviate an attack of epilepsy.

When a bat hibernates, says Koski, it essentially induces an epileptic condition by means of an unidentified trigger substance in the bloodstream. About once a month during the winter the bat is able to rouse itself (stop the seizure) to drink water. When disturbed, it can also return quickly to a normal wakeful state. If this rousing ability can be understood, and if the states of hibernation and epilepsy are as similar as the researchers suspect, man may learn how to "turn off" an epileptic fit.

Conversely, doctors would like to know how to turn on hibernation in surgical patients, replacing a rare and risky surgical technique called hypothermia, in which the patient is cooled to a temperature as low as 64° F in an ice bath. If the brain could be induced to lower body temperature naturally, the danger of the procedure would be lessened. Hibernation might also make possible long space journeys for astronauts, reducing their need for supplies and avoiding the danger of chronic boredom. □



Sunlight and the SST

Despite the pleas of the musical *Hair* to "let the sunshine in," any beachgoer knows empirically that too much sunlight hurts. During the dispute over the supersonic transport (SST) in 1971, it was suggested that a fleet of SSTs might reduce the amount of ozone in the stratosphere, letting too much sunshine in. Amid Washington rumors of an SST resurrection, an ad hoc panel of the National Academy of Sciences has now completed a report voicing the "utmost concern over the possible detrimental effects on our environment by the operation of large numbers of supersonic aircraft."

The cause of the anxiety is ultraviolet radiation (UV), that portion of the sunlight spectrum between the shortest visible rays and the longest X-rays. Normally, incoming UV is largely blocked by a thin but essential layer of ozone 10 to 20 miles above the earth, the altitude at which SSTs would fly. Some scientists fear that much of this ozone—a highly reactive molecule made of three oxygen atoms—would combine with the water and oxides of nitrogen in SST exhaust, thereby reducing the UV-blocking power of the ozone layer.

This layer is something we cannot afford to lose. The protective efficiency of ozone is so great that even a 5 per cent reduction over the mid-United States would cause a 26 per cent increase in UV radiation at harmful wavelengths; a 50 per cent decrease in ozone would yield a 1,000 per cent increase in radiation.

The effects of high doses of UV upon living things are so damaging that formation of the ozone layer was probably prerequisite to the evolution of life. Induction of the three most common malignant human skin tumors, for example, is correlated with exposure to sunlight. A 5 per cent decline in ozone, says the panel, would produce at least 8,000 "extra" cases of skin cancer per year among the U. S. white population (118,000 cases now are detected annually). In addition, UV causes skin changes that we normally blame on aging: wrinkling, discoloration, thinning, dryness, and blood vessel dilation. "Sunlight," continues the report, "is far more important than the passage of time in destroying the visage of youth."

UV also injures DNA, the essential carrier of genetic information in every cell. Although DNA has a limited capacity for self-repair, increased UV could overload the repair mechanisms, leading to deterioration and death of the cell or mutations among offspring.

The penetration ability of UV is especially worrisome. It passes through water easily enough to cause sunburn in bathers on cloudy days. The panel fears that an increase could upset ocean food chains by killing near-surface plankton. UV even can penetrate skin, muscle, and bone, reaching the depths of the brain. Some 25 to 75 per cent of UV radiation diffuses through woven fabrics, particularly the newer synthetics.

The theme of the report is smoothly summarized in this recommendation: "It must be made clear that life on earth is in a delicate balance between the beneficial and detrimental effects of sunlight." The very existence of the report, however, acknowledges the failure of the science community to supply data to the public during the SST information crisis. The panel recognizes this communications problem, chiding photochemists and photobiologists for not "demonstrating the relevance of their expertise to national problems." □

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SOCIAL SCIENCES

Slow Death for an Indian Nation

Since early 1972 Indian agent Claudio Villas Boas had been camped in the jungle of Brazil's Amazonia. Finally, on February 4, 1973, after 382 days of patient waiting, several members of the Kranhacãcore tribe emerged from the surrounding foliage to exchange gifts with him: beads and machetes in return for bows and arrows. His constant presence and the gifts that he had left hanging across a trail had finally overcome the fears of the Kranhacãcore, who had never before been contacted by non-Indians. (The beginning of his efforts to communicate with this tribe was documented in "The Tribe That Hides From Man," shown nationwide by National Educational Television on January 8.)

Orlando and Claudio Villas Boas with Indian companion

Claudio Villas Boas and his brother, Orlando, have spent more than 30 years in Brazil's interior and are considered by many to be the world's leading authorities on Native Americans. They have dedicated their lives to the protection of Brazil's Indians, and their work earned them a nomination for the Nobel Peace Prize in 1971. As members of Brazil's National Indian Foundation (FUNAI), they have made first contact with many Indian groups living within the unexplored regions of Amazonia.

On February 5, however, one day after making contact with the elusive Kranhacãcore tribe, they announced their intention of quitting FUNAI and leaving the Xingu National Park, an Indian reserve established largely through their efforts. According to Dr. Shelton Davis, an anthropologist at Harvard University who follows Brazilian Indian affairs, "The announced departure of Orlando and Claudio Villas Boas from the Xingu National Park and their retirement from FUNAI are entirely predictable. They are outraged by the malicious way in which the Brazilian Ministry of the Interior and FUNAI have refused to protect Indian land and territorial rights.

"In late 1970," he continued, "the lifelong struggle of the Villas Boas brothers was literally undermined when the Brazilian minister of the interior announced that 8,213 square kilometers of the Xingu Park would be alienated and one section of the Xavantina-Cachimbo highway would cut across the northern section of the park.

"This land encroachment, flagrantly illegal under Brazil's own federal constitution," Davis said, "uprooted several Indian groups and, through contact with the highway crews, generated a major flu epidemic. Now FUNAI refuses to protect the Kranhacãcores in their legitimate rights to property."

According to Davis, Brazil's present administration has completely abrogated the legal rights of Indians, and he feels Orlando and Claudio Villas Boas will leave their posts "so as not to be implicated in what can only be described as the systematic extermination—yes, I mean genocide—of Indian peoples in Brazil."

For most of us the word *genocide* conjures up such images of bloody massacres as the "battle" of Wounded Knee. In practice, however, genocide is usually a far more gradual and less spectacular kind of communal death, involving loss of native lands through both illegal and quasi-legal encroachment, loss of livelihood, the disappearance of native culture, and, ultimately, obliteration. Therefore, if any government permits encroachment on Indian land, whether by miners, hunters, or colonists, it is in fact committing genocide. The current exploitation of the Brazilian interior by cattle and mining interests, accompanied by a surge of road building, has caused more genocidal incidents than even the Villas Boas brothers can cope with.

As the brothers stated in a recent interview by the Brazilian paper *Jornal do Brasil:* "If a reserve for the Kranhacãcore is not immediately demarcated, and if a rigorous protection policy is not also developed, the destiny of the Kranhacore, as of so many other Indian nations, will be their ultimate destruction and disappearance."

SALLY BATES

Keeping Ahead of the Joneses

Richard A. Easterlin, professor of economics, University of Pennsylvania, reports that money can indeed buy happiness, but only if you have more money than the people around you. Past research in this country has suggested that the level of "happiness" is in direct proportion to personal income. However, in a comparative analysis of 19 countries, a summary of which appeared in the journal *The Public Interest*, Professor Easterlin found that rich societies aren't any "happier" than poor ones.

"Each person acts on the assumption that more money will bring more happiness," he concludes, "and, indeed, if he does get more money, and others do not (or get less), his happiness increases. But when everyone acts on this assumption and incomes generally increase, no one, on the average, feels better off." Happiness thus derives not from keeping up with the Joneses but from keeping *ahead* of them. □

Research Ethics Revisited

Since the American Psychological Association (APA) adopted its first code of ethics two decades ago, the profession has pushed its research forward into more visible and sensitive areas of the psyche and the society. Today there is less emphasis on rat responses. Rather, a researcher may stage a fake robbery and film bystanders' reactions or, to measure a subject's self-esteem, inform him (wrongly) that he has flunked a test. In some experiments the participants are clearly harmed by the experience.

In order to sensitize its members to the ethics of human experimentation and provide relevant standards, the APA recently released perhaps the most exhaustive treatment of the problem in all the scientific disciplines. The APA report discusses the use of deception, invasion of privacy, the creation of physical or mental stress, and the administration of drugs—in fact, any technique that threatens the welfare of the subject. However, the report stresses that human ethics and scientific ethics are often in conflict, that there are no absolutes, and that the final decision rests with the researcher. The only "thou shalt" is the insistence that the subject emerge unharmed—"or at least that he is exposed only to minimal risks to which he knowingly and freely consents." □

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PHYSICAL SCIENCES

Same Old Moon

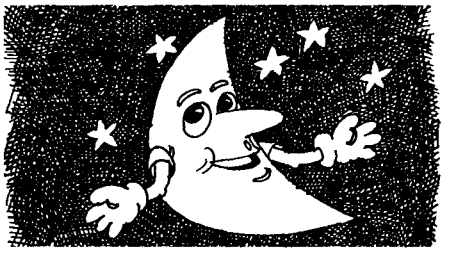
When Apollo 17's Harrison (Jack) Schmitt, sputtering with excitement, radioed back his discovery of orange soil during the astronauts' second exploration period, lunar geologists braced themselves for major revisions in theories of the geologic development of the moon.

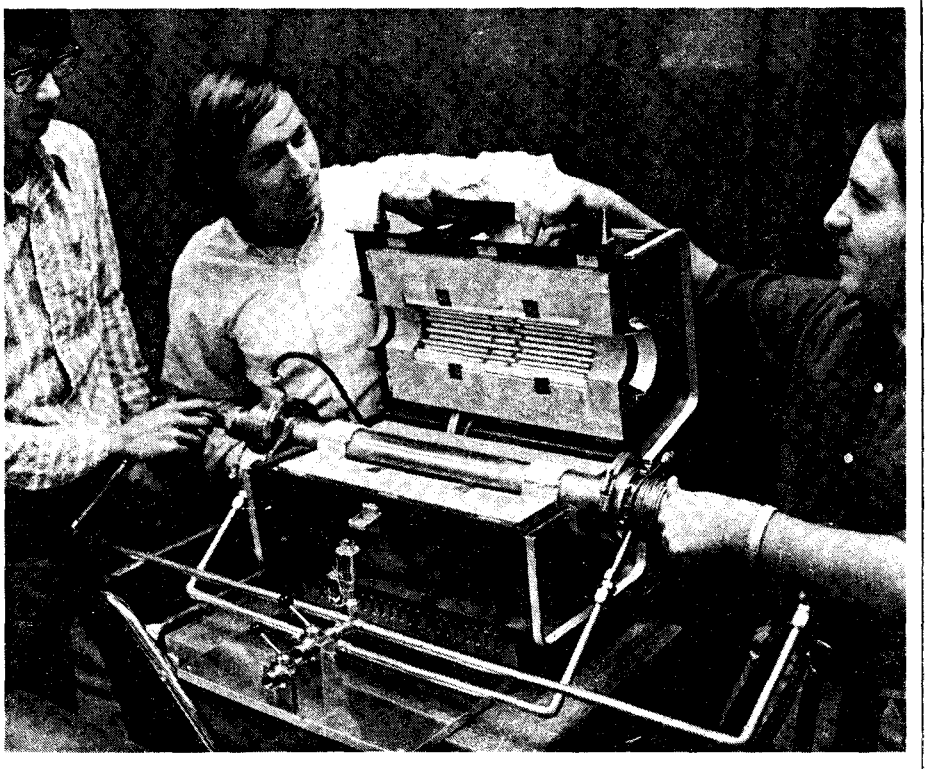
The rust-tinted soil, found near the edge of Shorty Crater in the Taurus-Littrow Valley, appeared to come from a volcanic vent. Schmitt's later estimate that the soil was only ten million or so years old would have indicated a seething, geologically active moon billions of years later than allowed for by current hypotheses. The find also would have provided support for scientists who were arguing that the moon shots were oriented too much toward engineering, by providing a moon-shaking discovery that only a trained geologist like Schmitt (the only scientist to reach the moon) was equipped to recognize.

However, after a month's investigation of the soil sample, a team of scientists at the State University of New York at Stony Brook have placed its age at 3.71 billion years, give or take 60 million. Their study, using potassium-argon dating techniques, revives the idea of the moon as a cold, long-dead body.

"It can now be reasonably stated," said Oliver Shaeffer, head of the Stony Brook lunar analysis team, "that volcanism on the moon was a phenomenon which ended about three billion years ago." Shaeffer speculated that perhaps the orange dust could have been thrown to the surface by a meteorite impact. According to James Papike, chairman of Stony Brook's earth and space sciences department, the dating of the orange soil doesn't completely rule out the possibility of recent volcanism elsewhere on the moon, but makes it less likely.

Meanwhile, 850 pounds of moon rock and dust are scattered throughout the country's laboratories, and the unravelling of the moon's history goes on. □





Manipulating a Laser

The device, designed by a research team led by James F. Young and Stephen E. Harris of Stanford University, is called a phase-matched metal vapor cell. It consists of a stainless-steel cylinder about three feet long and three inches in diameter, surrounded by an electric heating coil and firebrick. Inside the cylinder a vaporized mixture of cadmium and argon is held at a constant 1,000 degrees Farenheit.

The wonders begin when a laser beam is directed into one end of the vapor cell. Inside, a complex "nonlinear energy transfer" occurs between the laser beam and the atoms and molecules of the metallic vapor. The result: the laser beam emerges at the other end of the cell at exactly one-third its previous wavelength and exactly three times its original frequency.

To date, Young and Harris have lowered the wavelength of laser light from 3,547 angstroms (one ten-millionth of an inch) to 1,182 angstroms. They believe they can extend this technique to produce wavelengths of 132 angstroms or less.

The uses of a device that lowers the wavelength of laser light to this extent are considerable. In microscopy, for example, the production of shorter wavelengths can result in better resolution. This derives from a basic rule for microscopes: the shortest dimension one can see or photograph is approximately one-half the wavelength of the radiation illuminating it. If Young and Harris can produce laser light at about 132 angstroms, it may well be possible to photograph the molecular fabric of cells and viruses without killing them, as must happen with the electron microscope. (In the electron microscope, specimens must be photographed in a vacuum and are often laced with heavy metal dyes. Neither situation is conducive to life.) By means of holographic techniques, it would also be possible to produce three-dimensional images of living cells.

The vapor cell also may lend a hand in the development of controlled fusion reactions. In recent years scientists have been experimenting with lasers as a possible means of obtaining the extremely high temperatures required to trigger the fusion of hydrogen. Since the vapor cell increases the energy of each photon in the laser beam, it may lead to more powerful lasers that can more easily produce the required temperatures. □

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An Ancient Element

Astronomers from Williams College in Massachusetts and the California Institute of Technology recently announced the discovery of fundamental radiation from deuterium in interstellar space. Modern theories of the formation of the elements hold that all deuterium in the universe was formed in the first seconds after the so-called Big Bang, the superexplosion that, according to many scientists, marked the beginning of the universe we know it. Thus, the Williams-Caltech discovery is, in effect, a look back to ten billion years ago.

Deuterium is an isotope of hydrogen that is sometimes known as "heavy hydrogen." It consists of a nucleus of one proton and one neutron, orbited by a spinning electron. Occasionally, the spin of the electron flips over with respect to the spin of the nucleus, giving off radiation at a wavelength of 92 centimeters in the process. The hydrogen atom undergoes a similar spin-flip that results in the well-known 21-cm. radiation that, since its discovery 20 years ago, has enabled astronomers to chart the Milky Way Galaxy.

The astronomers detected the 92-cm. deuterium radiation by training a radio telescope on the center of the Milky Way for a period of eight weeks. This is like leaving the shutter of a camera open for several hours to pick up a faint image in the dark as opposed to snapping a fast exposure in the sunlight.

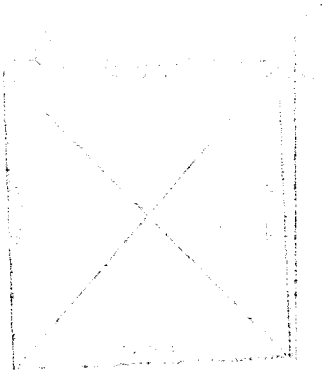
Jay M. Pasachoff of Williams, one of the astronomers involved in the discovery, explains that "stars deplete deuterium—they cook it into heavier elements. Thus, whatever deuterium we now find is left over from the Big Bang." □

Lessons From the Past

Galileo performed his famous experiment with falling bodies by using a long inclined track, metal and wooden balls, and a simple clock consisting of two water cans. When Faraday built the first electric motor, he used glass cups filled with mercury. This spring, these and other celebrated experiments will be duplicated in a history of science course taught by Don P. Engelberg at Queensborough Community College in New York.

Engelberg, who describes himself as a "history bug" who wants to "give students a taste of the philosophical and technological obstacles in the development of scientific ideas," will use for his course models of the actual devices built by the famous scientists of history. Included are replicas of Benjamin Franklin's electrostatic bells, Arrago's bar magnet experiment, Volta's battery, Young's diffraction grating, and various devices of Newton, Ampère, Chadwick, and Leonardo da Vinci. The models will be built as close to the original as possible. Galileo's inclined track, for example, is a long board that has been rubbed and varnished to simulate the parchment lining that Galileo actually used.

Engelberg hopes to impart to his students some notion of "the genius involved in understanding nature." Whether he succeeds or not, it sounds like a lot of fun. □



A Pyramid Askew

The pyramids of Egypt have long confounded archaeologists by the incredible accuracy of their construction. For example, using only primitive surveying instruments and considerable slave power, the architects aligned the sides of the Great Pyramid of Cheops at Giza (roughly 756 feet on a side) with less than an eight-inch error.

The mystery of how such accuracy was achieved is further compounded by one surprising flaw. The Great Pyramid of Cheops is skewed from a true north-south alignment by 5½ minutes of arc, far too much to be accidental. (At a radius of 100 feet, a separation of 5½ minutes of arc would be about ten feet.)

Writing in *Science*, G. S. Pawley of Edinburgh University in Scotland and N. Abrahamsen of Åhrus University in Denmark suggest that the discrepancy may be accounted for by the geologic theory of plate tectonics or continental drift. They argue that the Pharaoh's architects laid out the pyramid correctly but that in the intervening 45 centuries the African continent has drifted and pivoted counterclockwise enough to ruin the alignment.

The two scientists concede that simply extrapolating current continental-drift rates back in time would yield a figure too small to explain the displacement. But they note that the question whether the drift rates have been continuous or sporadic has not yet been answered.

To test their hypothesis, Pawley and Abrahamsen recommend a worldwide study of other large-scale ancient designs; such as the megaliths of Britain and Brittany and the plateau markings apparently carved by the Nasca people of Peru. These also are thought to have been based on accurate astronomical observations and thus hopefully will show evidence of having drifted out of alignment. □

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HEALTH & MEDICINE

Cultured Organs

The major problem facing routine organ transplants is the phenomenon known as rejection. To counteract rejection, doctors have resorted to immunosuppressive drugs, designed to suppress the body's tendency to attack the grafted organ. Furthermore, donor organs have been matched to specific recipients in hopes of combating rejection—a process similar to the way blood is typed before transfusion. On the whole, however, the problem of rejection has proved more formidable than originally thought. Proof of this is the near-perfect failure record of heart transplants.

Since the first transplants, scientists have been searching for alternate ways to combat rejection. Now it appears that Dr. William T. Summerlin, head of a transplantation biology effort at New York's Sloan-Kettering Institute, may have hit upon a solution.

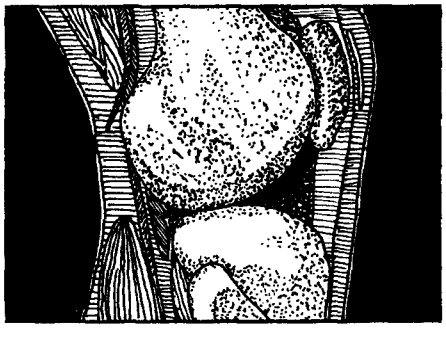
Summerlin's startling find is that organs lose their ability to trigger rejection if they are preserved for a specific length of time in nutrient solutions ordinarily used to keep cells alive. He began "organ culture" four years ago, first keeping human skin vital in solution for up to eight weeks before grafting it onto hospitalized patients suffering from burns. The transplants were successful despite the lack of initial compatibility—a lack that would normally have led to rejection.

Something important was happening to the skin during the time spent in organ culture. What that was no one now knows, but Summerlin has employed the technique to successfully graft pig skin onto mice, to transplant adrenal glands from one strain of mice to another, and even to transplant human corneas onto rabbits, all without the use of immunosuppressives.

Aside from skin transplants, the technique has not been directly applied to humans, but it offers some intriguing possibilities, among them restoring insulin balance to diabetics by pancreas transplants. Should the scientists discover what is actually happening in their culture dishes, the prospects are nothing short of fantastic. □

Making a Joint

There are about 20 artificial knees available on the prosthetics market, but none works as well as the natural one, which can bend, twist, and lock. The natural knee also is provided with a mechanism that redistributes body weight depending on its position; if it weren't for this



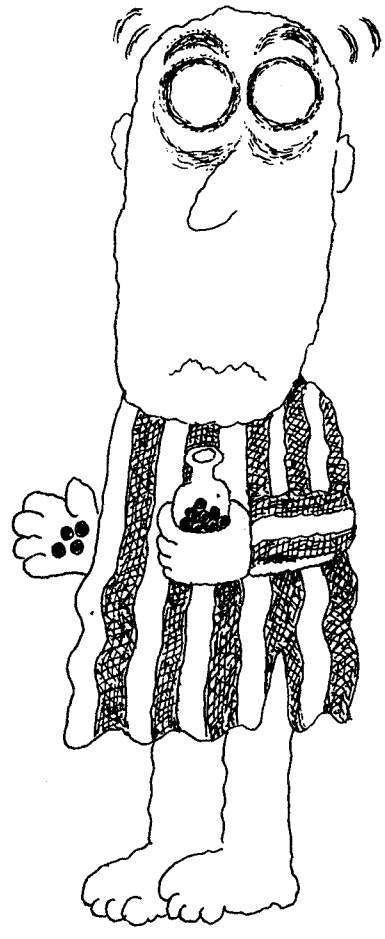
mechanism, standing from a squatting position would be nearly impossible.

Building an artificial knee that would mimic these functions is complicated by the problem that nobody actually knows what an intact knee looks like when it is functioning normally. The reason for this is that the joint itself is more than two bones butting against one another; it is the sum of cartilage, fluid, and a number of ligaments. In fact, the top of the tibia (the larger of the two bones of the lower leg) does not match the bottom of the femur (the thigh bone).

Dr. Frederick Ewald at the Robert B. Brigham Hospital in Boston now seems to have solved the problem by immersing the bottom of a femur that was removed from a skeleton into a bath of molten wax. The bone was then moved as it would move in a natural leg, and a replica of a knee began taking shape in the cooling wax.

Once hardened, the wax impression —with the femur removed—was an exact duplicate of the top of the tibia. It seemed that the motion of the upper leg bone had inscribed the necessary shape of the knee as well as the top surface of the tibia. The nonmatching surfaces of the two knee bones, Ewald found, are necessary for the joint to function normally.

Ewald built his knee replica by using polyethylene for the tibial end and a chrome-cobalt alloy for the femur surface. Before it is implanted in football players, arthritics, skiers, and anyone else who needs a new knee, the Ewald joint is being tested on a mechanical "genuflector" at the Harvard-MIT Joint Physiology Laboratory in Cambridge. By this summer it should be helping people walk. □



The Sedative That Doesn't

Thousands of people helped to make Compoz, as its familiar advertisement proclaims, "the largest-selling non-prescription sedative for temporary relief of simple nervous tension." However, according to two Philadelphia psychiatrists, this testimonial and others like it are no guarantee that the medication touted works at all. In their study of over-the-counter sedatives, reported in the *Journal of the American Medical Association*, the team headed by Drs. Karl Rickels and Peter Hesbacher found that Compoz, for example, provided about as much relief as a placebo, a sugar pill with absolutely no medicine whatsoever. Although it did not sedate, Compoz did cause more disagreeable side effects—drowsiness, dizziness, confusion, dry mouth, nausea—than Librium, a widely used prescription sedative that apparently does work. Rickels and Hesbacher conclude that OTC daytime sedatives should be seriously studied in controlled experiments before they are placed on store shelves. □

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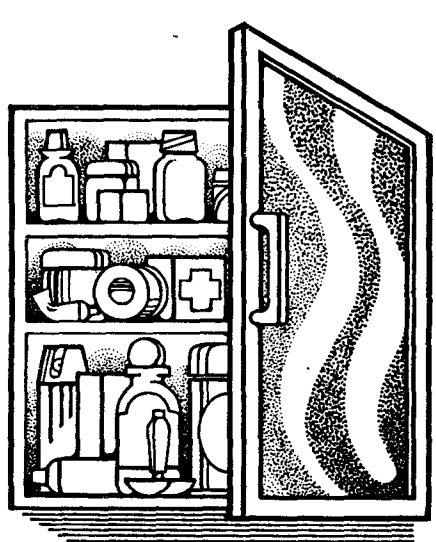
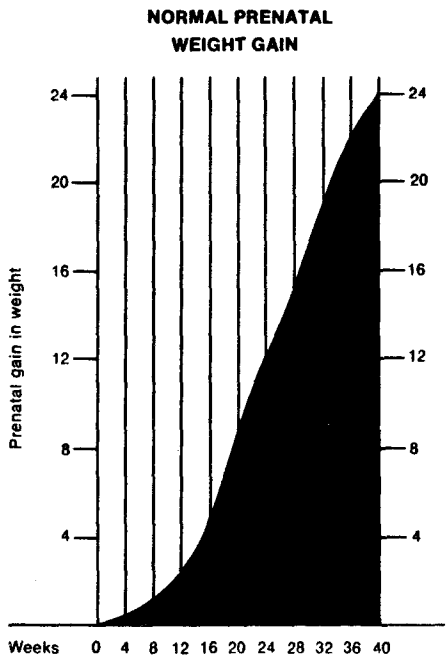
The Well-Stocked Medicine Chest

The American Academy of Family Physicians, whose members come the closest to being general practitioners, lists, in order of importance, the following items to remedy everyday aches, cuts, bruises, and what-have-you:

ASPIRIN
BAND-AIDS
THERMOMETER
ANTIBACTERIAL OINTMENT
TOPICAL ANTISEPTICS
ADHESIVE TAPE
GAUZE
ANTIDIARRHETIC (KAOPECTATE)
ANTACIDS
ANTIHISTAMINES
LAXATIVES
EMETIC (SYRUP OF IPECAC)
LINIMENT (RUBBING ALCOHOL)
COUGH PREPARATION
PETROLEUM JELLY
COTTON
HYDROGEN PEROXIDE
BURN OINTMENT
SKIN OINTMENT
EYE DROPS
MOUTHWASH
NOSE DROPS
CALAMINE LOTION
DRAMAMINE
EAR DROPS
TWEEZERS
Q-TIPS
SCISSORS
EYE CUPS
EPSOM SALTS

All the above-mentioned items are by no means hard-and-fast necessities. Indeed, the physicians themselves felt, by and large, that the top dozen were too many. From time to time we will update this list of medicine cabinet supplies, adding and deleting where advisable. In any case, all medicines should be kept child-proof; ordinary aspirin, for example, is one of the commonest childhood poisons. □





The Perfect Mom

After an 11-year study of 98 per cent of the babies born in Britain during a single week in 1958, Dr. Nevil Butler, professor of child health at the University of Bristol, has come up with a composite for the ideal pregnant woman. "If I were a baby, and could choose my mum," he told *Medical World News*, "I would have a nonsmoking, upper-class one about 25 years old, at least five feet five inches tall and a bit plump, but with a normal blood pressure."

Of the 17,000 babies he studied, Butler found that those who were underweight at birth experienced the most difficulties once they entered school. For example, those babies whose birth weight was two pounds (about 910 grams) below normal displayed a six-month lag in reading skills. Optimal birth weight, according to the World Health Organization's Expert Committee on Maternal and Child Health, ranges between 2,500 and 3,500 grams (5.5 to 7.7 pounds, a figure that will appear surprisingly low to many Americans).

The study suggests that cigarette smoking and the practice of restricting weight gain during pregnancy are linked to low-birth-weight babies. Of course, overeating could have worse consequences. The ideal weight gain during pregnancy, according to the National Research Council, a branch of the National Academy of Sciences, is about 24 pounds. □

The Surgeon's Fee

Why are people reluctant to discuss fees with their doctors? Some say that they are "afraid the doctor wouldn't like it" or that they "didn't want the doctor to think they were more interested in money than in medical care." But the most common reply, according to the *Bulletin of the American College of Surgeons*, is "it didn't seem like the thing to do."

Well, it is precisely the thing to do, insists the *Bulletin* in an article called, "Yes, but How Much Is It Going to Cost?" Because such fees represent the surgeon's livelihood, talking about them is as important to him as it is to the patient. The only reason that the doctor doesn't bring the subject up himself, the *Bulletin* says, is that he doesn't want the patient to think that *he* is interested primarily in money.

Impasse? If shouldn't be. The *Bulletin* advises that the patient himself take the initiative, broaching the subject with a direct question: "I'd like to talk about your fee." Once this is done, the resulting discussion usually touches on the various aspects of the treatment that insurance will cover and those for which the patient himself will be responsible.

The article goes on to describe situations where a particular operation is not included under surgical insurance, the workings of Medicare, and the reason a family's ability to pay is no longer as important a consideration as it once was in determining the doctor's fee.

This article is the first in the *Bulletin's* 56-year history to be directed more to patients than to doctors, and for that reason the editors are making reprints available for 10 cents from the American College of Surgeons, 55 East Erie, Chicago, Illinois. □

The Preservation of Grass

In order to quantify the dose of *Cannabis sativa* (better known as marijuana) needed to produce specific effects, physiologists must have some idea of how fast its potency declines.

To find out, scientists at the University of Mississippi who supply research samples of marijuana to National Institutes of Mental Health stored the weed at various temperatures. In a letter to the editor of the *Journal of the American Medical Association*, Carlton Turner and Kathy Hadley report that the the active ingredient—tetrahydrocannabinol—decays very slowly even at room temperature. While cannabis frozen at −18°C lost 3.8 per cent of its kick over a one-year test period, a sample kept at room temperature (22°C) for the same period lost only 7 per cent of its cannabinol content. □

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TECHNOLOGY

From FLIP to FLOPP

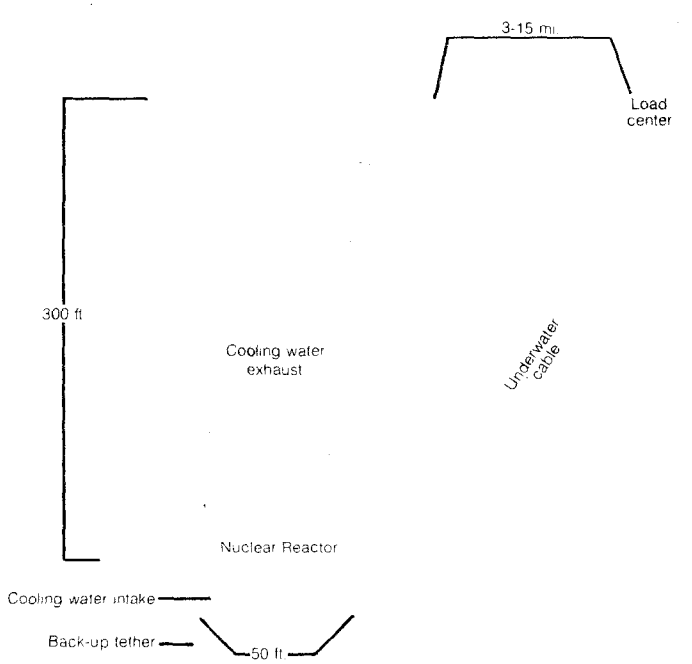
To float nuclear power plants in the ocean may be safer than to construct them on shore, particularly along the earthquake-prone West Coast. In recent years plans to build three nuclear power plants on the California coast were canceled at least partly because of geological uncertainties—each was scheduled for construction over a major earthquake fault.

A Rand Corporation engineer, Richard Salter, suggests as an alternative the generation of nuclear power in offshore clusters of giant "pop bottles." He calls his idea FLOPP (for Floating Power Platform), patterned after FLIP, a Floating Instrument Platform developed at the Scripps Institution of Oceanography. Like FLIP, FLOPP vessels would be constructed and hauled out to sea in a horizontal attitude and then submerged to a vertical position.

In addition to "seismic immunity," says Salter, the floating power plant would have favorable aesthetic and thermal aspects. Only the mouth of the bottle would be visible above the water, minimizing visual impact. For cooling purposes, very cold water would be drawn into the bottom of the module, more than 200 feet down, circulated, and then released near the surface without disturbing the surrounding water temperature.

The cooling water could be released through jets, helping to keep the vessel relatively stationary. Mooring tethers would act as a backup anchoring system. The floating power plant might be composed of three clusters of seven units each, generating some five million kilowatts of electricity—enough for the entire city of Los Angeles. Early-warning sensors surrounding each cluster would caution ships to stay away. In an emergency the cluster could be lowered below the surface.

Salter admits that his pop-bottle power plant is simply a preliminary concept requiring further elaboration. A more nearly complete offshore power plant design has been developed by a joint venture of Westinghouse Electric Corporation and Tenneco, Inc.—employing a floating platform in shallow water protected by a breakwater. Two such units are planned for the New Jersey coast. On the Pacific coast, where the water drops off rather steeply, Salter argues that the submarine approach is more realistic. □



Watching The Time

Your television set could soon become a digital clock. A new TvTime service, developed by the National Bureau of Standards, proposes to provide the precise time—not only for scientific and business subscribers, but also for the home audience.

TvTime would be transmitted as a digital code in the "vertical interval"—that horizontal black bar seen when the television picture rolls. The time wouldn't be seen on a normally adjusted set. It would require a specially purchased circuit to decode the information and display it on the screen.

In addition to time information, the system, capable of carrying up to 600 data bits per second, also could caption television programs for the 13 million persons in the country who either are deaf or have impaired hearing. Last year ABC cooperated in a successful NBS experiment, captioning the show *Mod Squad* for a large audience of deaf students at Gallaudet College in Washington, D.C.

Another extension of TvTime is channel identification on the screen. This indication would facilitate station tuning, particularly as the number of operating UHF and cable channels increases. According to NBS engineer George Kamas, there is television capacity for 69 UHF channels alone.

Responsible for disseminating standard measurements, the National Bureau of Standards developed the TvTime system to transmit accurate information to the thousands of commercial and scientific institutions requiring precise time—among them the transportation, telephone, computer, and power industries, as well as the broadcast business itself. The system could synchronize clocks at widely separated points and serve as an inexpensive time code receiver, automatically resetting all clocks and processes in a system at the same time.

The primary time and frequency standard for the country is the atomic clock system maintained at the NBS laboratories in Boulder, Colorado. At present these standards are disseminated to users via radio broadcast (inexpensive but less accurate) and by portable atomic clocks (highly accurate but costly). The TvTime method combines high accura-

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cy, dependability, and low user cost, since the coded signals ride "piggyback" on existing television broadcasts.

The Commerce Department has petitioned the Federal Communications Commission for approval of the new TvTime system. If the FCC authorizes it, the National Bureau of Standards would provide the major public and private networks with equipment for originating timing signals. Local stations could either pass on the network signals or originate their own TvTime signals. Receivers would pay for special decoders according to use. The simplest circuit addition to a home set—an hours-minutes-seconds decoder—might cost

about $20 if mass-produced and installed at a factory. Captioning circuits might run between $50 and $100. More precise time decoders—some accurate to millionths of a second—are estimated at $1,500 in small quantities.

TvTime is just a beginning in the imaginative new uses of television. With the advent of two-way cable TV, your set may soon become a computer terminal, allowing you to vote, shop, or attend school right from the living room, as well as consult with a central computer on a variety of topics. On the other hand, there is growing concern that while you are busy tapping new information, your television set at the same time might be learning from you—either by direct observation or by monitoring your viewing habits. □

Freezing Old Tires

Since the automobile became popular, some 2.5 billion discarded rubber tires have been scattered around the countryside. This year alone more than 240 million will mar the landscape. Because degradation is extremely slow and burning old tires pollutes the air, environmentalists have nearly despaired of healing this blight.

A new approach—freezing—offers hope not only of getting rid of refuse rubber but also of extracting more mileage from it. By cooling tires to −80 degrees F, the point at which they become brittle, researchers at the University of Wisconsin have shown that the tires can be instantly fragmented when passed through a hammer mill. Once the tires are beaten into a powder, the components can be efficiently separated and eventually reused.

Norman Braton, director of the Wisconsin research project and vice-president of Cryogenic Recycling International, Inc., plans to have a mobile cryogenic (low-temperature) recycling unit ready for demonstration by June. Weighing about 30,000 pounds and riding on the back of a 30-foot truck, it could service tire dumps over a large area. After cooling the tires with liquid nitrogen, the proposed unit could pass 30 tires a minute through a hammer mill, shattering them into rubber, fabric, and wire. The original volume of the rubber is reduced by 82 per cent to an easily transported powder form.

Braton estimates that 20 of these freezer-crushers, operating continuously five days a week, would be required simply to keep abreast of the current tire problem. Attacking the enormous tire backlog would require a fleet. Each of the devices might cost $100,000.

Finding a market for the recycled tire materials is the next problem. Braton optimistically points to the use of rubber as a bonding material in asphalt highways. Arizona has already laid rubberized asphalt on streets and airport aprons, and Wisconsin is testing the idea. Tire fabric is under consideration as a fill for certain plastics.

The pollution-free cryogenic process is so versatile, says Braton, that it could be used to reclaim anything that becomes brittle when frozen—"Recycling tires is just the beginning." (He plans to visit a Belgian industrialist who freezes the entire automobile for recycling.) University of Wisconsin researchers also expect to recover valuable metals from used power and telephone transmission cables. The Environmental Protection Agency is interested in testing the cryogenic process for separating the metals in beverage cans.

Perhaps the most unusual cryogenic application is in commercial rat raising. A rat farm, which now buries more than 1,000 pounds of unmarketable rats each week, has cooperated with the University of Wisconsin in experiments to recycle the discarded animals by freezing and pulverizing them into nutritious food for their fellow rats. □

A Trans-Alaskan Tube?

The U.S. Court of Appeals ruled recently that the Trans-Alaskan Pipeline System would violate the Mineral Leasing Act of 1920, which restricts the width of any right-of-way through public land. The oil companies thus received another severe setback in their campaign to bring crude oil down from Prudhoe Bay in northern Alaska. Since the court did not even consider the thornier environmental questions involved, the pipeline could now be held up for several more years.

The setback has given new life to an alternative proposal by Berkeley engineering professor T. Y. Lin, perhaps the world's foremost authority on prestressed concrete construction. Lin has designed an integrated transport system consisting of an elevated 40-foot concrete tube. It would carry not only six 48-inch pipes but also two all-weather high-speed rail lines and two exposed rail lines, both of which could carry anything from construction supplies to tourist automobiles.

The main difficulty, of course, is financing, since an 800-mile-long giant tube traversing Alaska would cost some six billion dollars. However, Lin estimates that this cost would be repaid by utility fees and transport tariffs in 15 to 20 years. Furthermore, since the tube would rest upon pillars 50 feet above the permafrost, its effect on the environment would be minimal. Construction would be achieved by an automated 1,000-foot steel launching truss, which is already used for building bridges. The truss fits precast sections of tubing into place and sinks the supporting tiers without requiring a construction road on the ground.

If Alaskan oil reserves are as vast as some geologists suspect, and if natural gas is found, as others predict, the Lin tube could facilitate the laying of safe, enclosed pipes to mitigate the U.S. energy crisis.

For the future, Lin proposes other branches of this system extending across the Bering Strait to Siberia, which holds an estimated 800 trillion cubic feet of gas reserves, enough to supply Russia and the United States for 30 years. Oil reserves in the Soviet Union may be greater than those in the entire Middle East. Lin sees no engineering difficulties in bridging the 50-foot-wide, 160-foot deep strait, whereas supertankers, another alternative, would demand special deepwater unloading facilities on the West Coast as well as construction of the tankers themselves. □

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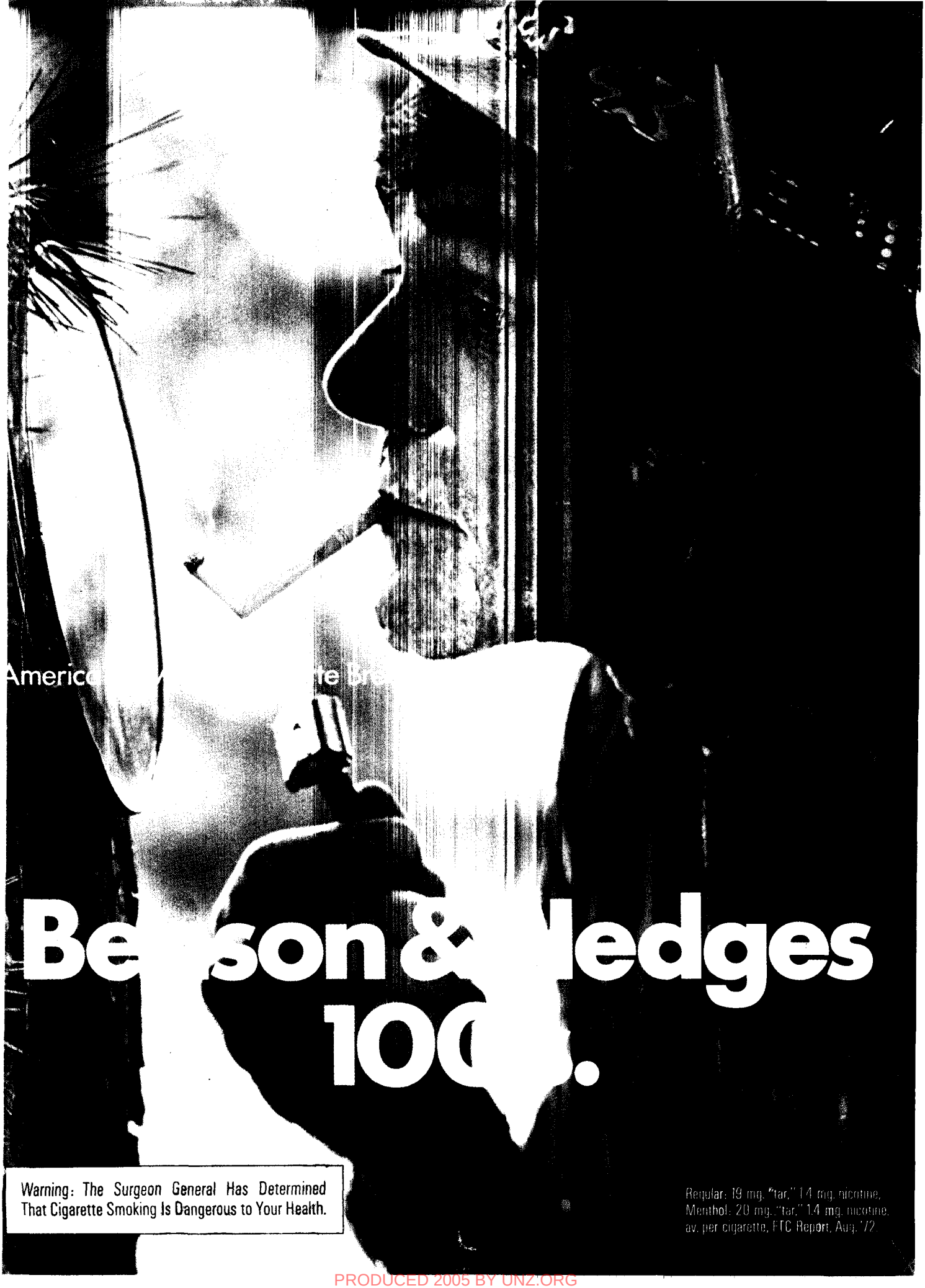
Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.
Regular: 19 mg. "tar," 1.4 mg. nicotine, Menthol: 20 mg. "tar," 1.4 mg. nicotine, av. per cigarette, FTC Report, Aug. '72.

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BOOKS

BY JANE HOWARD

ENCOUNTER GROUPS: FIRST FACTS. By Morton A. Lieberman, Irvin D. Yalom, and Matthew B. Miles. 495 pages. Basic Books. $15.

THE PIT: A Group Encounter Defiled. By Gene Church and Conrad D. Carnes. 161 pages. Outerbridge & Lazard. $6.95.

THE ENCOUNTER GAME. By Bruce L. Maliver. 250 pages. Stein & Day. $7.95.

"Well," one is asked from time to time if one's name is for any reason linked with the human potential movement, "do encounter groups work?"

The question invites impudent, interrogative replies. Do movies work? Sure, if you like the director and the actors. Do afternoons at the beach work? Certainly not, if someone drowns. Encounter groups, to which some five million persons are said to have repaired, probably for five million reasons, are as unpredictable as the people in them.

Those who lead these groups, in their celebrated reverence for gut feelings and the here-and-now, apparently have not spent much time in intellectualizing about their work or its consequences. A dearth of scholarly research concerning the subject has hitherto made it equally, glibly possible for detractors to lambaste encounter groups and for champions to proclaim that here, at last, is a cure for much of what ails Western civilization. Both such extreme views are, of course, ridiculously oversimplified, but three new books about the subject should tend to dampen the enthusiasm of the undecided.

Encounter Groups: First Facts, based on an exhaustive study at Stanford University by Morton A. Lieberman, Irvin D. Yalom, and Matthew M. Miles, is billed as the first scientific report of any magnitude. You can tell that these gentlemen have worked hard, because their prose sounds tired. It may soothe insomniacs and please those fond of argot like "input overload and value shuffle," but it is unfortunate that it isn't more readable, because this book is a solid and important achievement. In academic 1968–69, 210 Stanford undergraduates were recruited and divided randomly into 17 different encounter groups, for participation in which they received three hours' credit. Two of the groups were led only by tape-recorded instructions, the others by human professionals (all male, one can't help noting), whose philosophical approaches included Gestalt, Transactional Analysis, Synanon games, "Esalen eclectic," and others.

All the groups met for 30 hours, dividing up the time as they saw fit. (Those with fewer, longer sessions worked best.) Everything was taped. All the sessions were observed and much analyzed. Participants were later classified as High Learners, Negative Changers, and Casualties. Casualties, defined as those who "as a direct result of . . . experience in the encounter group, became more psychologically distressed and/or employed more maladaptive mechanisms of defense," were interrogated with particular care.

The rate of casualties, the authors found, was an "alarming and unacceptable" 10 per cent. Chances of "clear, positive benefit" proved to be about one in three. Psychotherapy seemed a surer route to "positive change." Only 16 per cent of the participants had "peak experiences" during the course of the groups. Gimmicks and structured exercises did not prove especially valuable. People who told a lot of secrets did not benefit appreciably more than people who kept their mouths shut. Racial attitudes were not much changed by the groups. The here-and-now did not turn out to be so sacrosanct after all; the there-and-then was found to have its place in group process, too.

Is there any valid way, the scholars wondered, of certifying good leaders and weeding out dangerous or ineffective ones? Probably not; degrees and diplomas don't guarantee expertise. Well then, is it possible to screen out group members for whom participation might mean undue risk? Maybe so, they suggest: such people could be warned, if not excluded before the groups begin. Cheeringly, they report, "humans have minds, and it appears that they need to use them in encounter groups and afterward, if benefits are to ensue." So much for anti-cerebral critics.

Most urgently, the authors ask the deepest possible respect for the "tenacity and self-preservatory functions" of defense mechanisms and emphasize that "to attack an individual in an effort to dislodge him from familiar defensive niches is crude and often counterproductive; to attack him punitively because he refuses to comply with a leader's time-table and route for change is ignorant and censurable."

Censurable indeed, as Gene Church and Conrad D. Carnes make clear in *The Pit: A Group Encounter Defiled*. Their book is an account of an unspeakably degrading four-day group that Church attended in 1970. The encounter in question, one of several sponsored by an organization called the Leadership Dynamics Institute, cost its members $1,000 each and obliged them to urinate on each other and subject themselves to torture, in the name of "honesty." Most of the group members

Jane Howard is the author of Please Touch: A Guided Tour of the Human Potential Movement.

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If you turn to the last page of this magazine first every week . . . here's good news for you.

The first in a new series of Double-Crostic books has just been published. The puzzles, all of which will be brand-new, are worked out by Janet Elliott Cameron, whose sophisticated Double-Crostics appear every week in *Saturday Review*. Three volumes will be published this year. Each will contain fifty puzzles, including an occasional cryptic or diagramless game.

If you're new to the game, try this sample puzzle. We bet you'll turn to the last page next.

DEFINITIONS	WORDS
A. Vanish, go away	53 45 30 74 55 131 69 98 / 127
B. Composer of Roman pieces, full name	9 22 38 62 143 59 109 132 / 14 29 97 83 120 116 48 6
C. Land farthest north (2 wds.)	92 18 68 135 99 115 104 88 / 148 44 151
D. Ancient board game	77 149 125 81 61 84 140 119 / 51 46
E. Cultured, literate	65 15 39 35 105 150 144 134
F. Former comic strip heroine (full name)	64 43 101 13 85 108 136 33 / 142 117 152
G. Cryptic: Instruction to road builder faced with mountain (3 wds.)	26 56 47 67 86 70 24 100 / 50 93 139 63 133 73 19
H. Buck Rogers' vehicle	128 2 12 11 25 58 54 95 / 114 91
I. Monkey's musical companion (2 wds.)	40 37 5 21 90 137 52 71 / 32 145 49 106
J. Arguments, disputes	82 147 17 31 3 141 27 89 / 130
K. Said of one heavily armed (3 wds.)	57 126 1 123 102 110 96 4 / 87 76
L. Inherently	42 7 138 79 94 112 8 20
M. Personal, movable property	75 111 36 103 122 129 78
N. Bosh (3 wds.)	107 23 28 16 41 118 80 113 / 60 10 121 34 66 72 146 124

			1 K	2 H		3 J	4 K	5 I	6 B	7 L		8 L	9 B	10 N	11 H							
	12 H	13 F	14 B	15 E	16 N	17 J	18 C	19 G	20 I		21 I	22 B		23 N	24 G							
25 H		26 G	27 J	28 N	29 B	30 A		31 J	32 I	33 F		34 N	35 E	36 M	37 I							
38 B		39 E	40 I		41 N	42 L	43 F	44 C		45 A	46 D		47 G	48 B	49 I							
	50 G	51 D	52 I	53 A	54 H		55 A	56 G	57 K	58 H	59 B	60 N	61 D		62 B							
63 G	64 F		65 E	66 N	67 G	68 C	69 A	70 G		71 I	72 N		73 G	74 A	75 M							
76 K		77 D	78 M	79 L	80 N	81 D		82 J	83 B	84 D	85 F	86 G		87 K	88 C							
89 J	90 I		91 H	92 C	93 G		94 L	95 H	96 K		97 B	98 A	99 C	100 G								
101 F	102 K	103 M	104 C	105 E	106 I	107 N		108 F	109 B		110 K	111 M	112 L		113 N							
114 H	115 C	116 B	117 F	118 N	119 D		120 B	121 N		122 M	123 K	124 N		125 D	126 K							
127 A	128 H	129 M	130 J	131 A	132 B	133 G	134 E	135 C	136 F	137 I		138 L	139 G	140 D	141 J							
142 F	143 B	144 E	145 I		146 N	147 J	148 C	149 D	150 B	151 C	152 F											

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worked for a cosmetics concern called Holiday Magic, Inc. (with which Leadership Dynamics Institute was affiliated), and had apparently been told the experience would help them in their jobs. Several are now suing, which is no wonder. What is a wonder, however, is that they stuck with it through the full four days.

Bruce L. Maliver's *Encounter Game* is an overview of the human potential movement's present state, and it is both less sensational than *The Pit* and less pedantic than the Stanford study. Humor and insight leaven Maliver's observations, which grew out of a piece in the *New York Times* Sunday magazine. It is probably true, as he says, that the encounter movement has peaked. "The human need for magic," as he points out, "is deeply ingrained and insatiable," but styles of magic shift.

Maliver tells of a bright young man who turned up at Esalen, lived there for a while as a resident trainee, hung around the Big Sur country, went through a lot of changes, and killed himself. The suicide's father flew out to try to piece together what had happened. An Esalen official, talking classic encounterese, said, "Let me put myself in your shoes, and I am the father, and I am here to talk, and this is what I hear you saying."

"I wanted to hear what *he* had to say," said the father, "not what he heard me saying." Fair enough. One hears all these authors agreeing with Maliver that "encounter is not a solution but the symptom of a problem." The solution is not to drive encounter groups underground, which would make them more exotic and surely much more dangerous. The solution, rather, would seem to be to make the experience of communion, in search of which most people join encounter groups, a less rare thing. It does not seem close at hand. □

The Better Half

THE PSYCHOLOGY OF CONSCIOUSNESS. By Robert Ornstein. 247 pages. Viking. $8.95.

BY SCOT MORRIS

With the acceleration of serious, not just frivolous, interest in matters occult in recent years, the need for communication, and for an exploration of possible syntheses, between the scientist and the mystic has become obvious—if not to reconcile their differences, then at least to clarify what the differences are. One promising approach may lie in the recent neuropsychological research on the two sides of the brain discussed in *The Psychology of Con-*

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sciousness by Robert Ornstein, a research psychologist and teacher.

Physiologists noted long ago that in the vast majority of people the left side of the brain is something special. Patients with brain damage in the left hemisphere appear more disturbed, more impaired, and more in need of hospitalization than patients with identical damage on the right side. Old physiology texts commonly referred to the left half of the brain as the "major hemisphere" or the "dominant side," relegating the right hemisphere to "minor, subordinate" status.

It now appears that each hemisphere is "dominant," in its own way, for certain types of skills and modes of thought. The left hemisphere, in most people, is dominant for language and verbal reasoning—clearly critical skills for life in the verbally oriented Western world—the right hemisphere for nonverbal skills, such as sensing spatial relationships, body image, or movement. A person with a right-side tumor may keep all his language skills but be unable to recognize objects, faces, or melodies. He may define the word *square* perfectly but be unable to draw one.

The two hemispheres also seem to follow different rules of thought and be responsible for different modes of consciousness—the left side rational, analytic, objective, and linear; the right side intuitive, holistic, subjective, and nonlinear. The gulf between scientists and mystics, then, according to Ornstein, may indicate that the two schools of thought are expressions of the two sides of the human brain. Ironically, when they call each other "narrow-minded" and "one-sided," they may be closer to the truth than they realize.

If the logical, linear Western scientist is ever fully to appreciate the truths of the Oriental philosophies, he may have to overcome his habitual, left-hemisphere biases and cultivate the neglected, intuitive consciousness of the other side—an argument that Ornstein first approached in his earlier book with Claudio Naranjo, *On the Psychology of Meditation* (1971), and that he restates throughout *The Psychology of Consciousness*. Ornstein emphasizes how important it is for scientists to recognize that their methods provide knowledge of only one type of reality, and that there exists what Carlos Castaneda calls "a separate reality," which must be apprehended intuitively, through legitimate but nonordinary modes of consciousness.

Ornstein's emphasis is misplaced here, I believe, for most scientists are probably quite willing to accept the possibility of different, unfamiliar forms of consciousness, but they aren't ready to undergo the rigorous training and meditative discipline necessary to experience them directly. The fact is that occult, Eastern philosophies are not always and completely beyond the grasp of reason, and many of their mysteries may yield to scientific understanding, without personal experience, if one looks

Scot Morris is a freelance science writer with a doctorate in clinical psychology.

SR RECOMMENDS

A rotating selection by the book review editors of ten particularly notable new and current books of general interest, arranged alphabetically by title.

DEEPER INTO MOVIES. By Pauline Kael (Atlantic-Little, Brown, $12.95)—This huge new collection of movie reviews (1969–1972), by a critic whose writing combines intelligence, enthusiasm, wit, and clarity, serves also as a record of current interaction between movies—our national theater—and our national life.

GRAVITY'S RAINBOW. By Thomas Pynchon (Viking, $15)—A mammoth new novel—in size, complexity, and theme—set toward the end of World War II and concerned in part with our relationship with technology.

HARRY BRIDGES: The Rise and Fall of Radical Labor in the United States. By Charles P. Larrowe (Lawrence Hill, $8.95; paperback, $3.95)—A detailed and largely sympathetic study of the vigorous, controversial career of one of America's most important labor leaders and of the powerful union he helped to organize—the International Longshoremen's and Warehousemen's Union.

HARRY S. TRUMAN. By Margaret Truman (Morrow, $10.95)—A frank and openly affectionate biography of the former President by his daughter.

HOME COMFORT. Edited by Richard Wizansky (Saturday Review Press, $8.95)—A handsomely published and completely beguiling collection of first-person accounts (with illustrations) of the joys, hassles, challenges, and accomplishments—practical and spiritual—of life on a communal New England farm.

HOUR OF GOLD, HOUR OF LEAD: Diaries and Letters 1929–1932. By Anne Morrow Lindbergh (Harcourt Brace Jovanovich, $7.95)—Continuing from *Bring Me a Unicorn*, this second volume of memoirs covers the early years of marriage to Charles Lindbergh, the kidnapping (and murder) of their first son, the enormous publicity that intruded on their lives, and recounts it all with quiet emotion, courage, and grace.

MY LIFE IN THE MAFIA. By Vincent Teresa with Thomas C. Renner (Doubleday, $8.95)—A lively and compellingly readable account of the Mafia by a top-ranking insider who turned informer—his testimony helped indict more than 50 gangland figures—and whose story a gifted reporter has assembled (and checked) from taped interviews conducted in the limbo of Teresa's hideaways.

NOBODY EVER DIED OF OLD AGE. By Sharon R. Curtin (Atlantic-Little, Brown, $6.95)—A powerful, personal, and affecting essay about how this country regards (and treats) its elderly, how they regard themselves, and what they might do about it.

OUR BODIES, OURSELVES. By the Boston Women's Health Book Collective (Simon & Schuster, $8.95; paperback, $2.95)—A complete medical guide for, about, and by women, and a breakthrough book of feminine consciousness.

THE POLITICS OF A GUARANTEED INCOME. By Daniel Patrick Moynihan (Random House, $15)—This well-written, detailed account of the fate of the most far-reaching social legislation proposed since the New Deal provides a rare inside view of the workings of government and the pressures of politics.

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beyond their often obscure, metaphorical terminologies and reexamines the meditative experiences in scientific terms. Ornstein recognizes the possible use of this approach, but he doesn't recognize how important it will be in finally bridging the gap between science and mysticism.

Scientists will achieve their first understanding of intuitive, mystical philosophies, not by becoming mystics, but by interpreting mystical experiences, as far as possible, in their own terms. This possibility is becoming greater and greater with advances in research. The discovery of a relationship between dream reports and rapid-eye-movement (REM) sleep, for example, gave behaviorists their first entrée to the objective study of dreams.

Biofeedback research, to cite another example, has not necessarily enabled scientists to alter their own blood pressures, stop their pulses, or walk painlessly over hot coals, but it has given them a better idea of what the yoga student goes through to learn these feats. The yogi may have to eliminate conscious distractions through strict, esoteric discipline before he can attend to the faint signals in his body and learn to control them; the biofeedback machine amplifies the inner signals so that the user may hear them above the cacophony of normal consciousness. But the principles of feedback learning are the same in each case, and this makes yoga a bit less mysterious and inscrutable.

The Psychology of Consciousness is a valuable work and goes a long way toward achieving a synthesis between rational and intuitive schools—but its impact is compromised by its impractical emphasis. If science and mysticism are ever to learn from each other, the most useful course will not be to persuade the scientist to forsake his academic position for a lotus position, as Ornstein might have him do, but, rather, to translate the real phenomena of occult experience, so far as it is possible, into scientific terms. Once the esoteric philosophies lose their cabalistic, supernatural ring to Western ears, we may begin to appreciate the wealth of knowledge they have been accumulating over the centuries. Then, perhaps, it will be time for scientists to drop their test tubes and start contemplating their navels. □

Answer to **Literary Crypt**, page 24:
To speak ill of others is a dishonest way of praising ourselves.
Will Durant

Answer to **Wit Twister**, page 24: sprout, Proust, stupor.

A Question of Ethics

REINVENTING ANTHROPOLOGY: Edited by Dell Hymes. 470 pages. Pantheon. $12.95.

BY SALLY BATES

It has proved to be a myth that anthropology, the "science of man," is a discipline with concepts and theories based on objective work by professional scholars. As many anthropologists now realize, claims of scientific "objectivity" are apt to be inflated, and scholarly activities are not without political overtones—a realization that has come out of a series of disturbing events over the last decade. *Reinventing Anthropology*, a collection of 16 essays edited by Dell Hymes, deals with the problems raised in anthropology during that period; yet it seems less instructive than the events themselves. Although the essays are concerned in part with questions of conscience, ethics, relevance, and social responsibility, it presumes a reader's knowledge of the climate of opinion that prompted them.

Until the early 1960s, anthropologists studying tribal and peasant peoples were assumed to be ethical individuals researching problems relevant to their disciplines. Most research was conducted at the village level: the anthropologist lived in a village of his choosing and collected data on a subject of interest to him. The information gathered eventually found its way into the public domain through doctoral dissertations or articles in technical journals. Ethical guidelines were few and unwritten: individuals within the village were never identified, the village itself was often given a pseudonym, and the anthropologist was expected to "identify" with "his" villagers and to feel "protective" toward them generally.

Then, in 1965, a scandal occurred linking social scientists (anthropologists included) to espionage and subversion efforts on behalf of the U. S. government: Project Camelot. A multimillion-dollar scheme funded by the army and carried out through the Special Operations Research Office of American University in Washington, D. C., Project Camelot was, in army parlance, a social science research project "on preconditions of internal conflict, and on effects of indigenous governmental actions—easing, exacerbating or resolving—on these preconditions," i.e., on counter-insurgency. The research was to be carried out predominantly in Latin America. As it turned out, the Norwegian

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Sally Bates is an associate editor of SR of The Sciences.

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sociologist Johan Galtung blew the whistle: the program became public knowledge, and in the ensuing international controversy, Project Camelot was terminated. For anthropologists, however, it signaled a loss of innocence. People in Latin America, Africa, and Asia who had given anthropologists their confidence discovered that the resulting information might be used *against* them. Now India, for example, no longer allows large-scale research projects with U. S. government funding within its borders (individual research, regardless of backing, is still permitted).

The Project Camelot debacle, combined with several related incidents, brought pressure on the American Anthropological Association, the profession's organizational arm, to patrol the activities of its constituents, and in 1968 the association formed an Ethics Committee. This committee, however, was given no specific instructions or powers beyond the task of "exploring" the question of ethics. Then Eric R. Wolf and Joseph G. Jorgensen, two committee members acting on their own initiative, published a long article in *The New York Review of Books* (November 17, 1970) detailing the secret activities of a counterinsurgency "research" group in Thailand. The evidence presented in the article was damning and precipitated heated debate within the profession: Can (should) anthropologists control the use of their published data? Should anthropologists work on classified federal projects? These questions inevitably led to a critical examination of the profession, a situation that rapidly degenerated into battles between "conservatives" and "radicals." (And the association, in embarrassment, appointed a conservative Ad Hoc Committee to investigate the Ethics Committee.)

The radical position, parts of which are represented in *Reinventing Anthropology*, attacks ideas basic to traditional anthropology. As a discipline, radicals argue, anthropology is not so much the "science of man" as it is the study of "dominated colored peoples living outside the boundaries of modern white societies," to quote the redefinition given by William S. Willis in his essay, "Skeletons in the Anthropological Closet." Nor did anthropology evolve in a vacuum. Eric R. Wolf's essay, "American Anthropologists and American Society," points out that the history of the discipline in this country

Say Cheese

X-RAYING THE PHARAOHS. By James E. Harris and Kent R. Weeks. Illustrated. 195 pages. Scribner's. $10.00.

Although the subject of this book—x-raying mummies—may seem both specialized and somewhat macabre, not the sort of thing many people are likely to be found doing on a rainy Sunday, the book itself is a good example of the presentation of highly technical research in terms that are accessible to the average reader. James Harris is a professor of dentistry, and Kent Weeks is an Egyptologist. Together they headed a research team from the University of Michigan that studied the royal mummies in the Egyptian Museum in Cairo in order to answer questions about "anthropology, medicine, and mummification."

A head X ray of the mummy of Amenhotep I, from X-Raying the Pharaohs

If some of the specific things they discovered seem less than earth-shaking (for example, that Ramses II had abscessed teeth and arthritis, poor man), the techniques and processes involved in their work are highly interesting and their findings significant for Egyptology and for our knowledge of ancient medical practices. The book is lucidly written and filled with fascinating details about the various processes of mummification, the relation of mummification to ancient Egyptian religion, and the vexing problem of just how one goes about x-raying a mummy. (Slowly, it turns out.) There is even a certain unexpected poetry to it all: "When the body was removed from its museum case the smell of delphiniums, which had been wrapped with the mummy, was a pungent reminder of how well Egypt's dry climate preserves organic remains."

The book's photographs are extraordinary. If your idea of a mummy is Boris Karloff staggering around wrapped in soiled linen, forget it. These folks are much nobler looking and far, far eerier.

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is inextricably linked to the social, political, and economic context of American society. Consequently, the problems to which anthropology addresses itself are only those that are important to and defined by white society.

Furthermore, although anthropology claims interest in "whole cultures," historically only the lower strata of dominated societies (including Indians and blacks in the United States) have been studied. As Laura Nader asks in "Up the Anthropologist," why is it that power elites in this country and elsewhere have been ignored? A corollary to this question is why "primitive cultures" are treated as islands isolated from the economic and technological forces of industrialized society.

What the contributors to *Reinventing Anthropology* fail to make clear, however, is that "relevance" often hinges on one's definition of social responsibility: studying counterinsurgency, for example, is highly relevant, but is it ethical? The radicals say no but fail to take into account the fact that almost *any* kind of data, "relevant" or not, can be misused. What, then, *is* ethical?

It must be remembered that anthropologists, unlike lawyers and doctors, are not licensed, and if they do something considered wrong by their peers, they can't be "disbarred." Certainly the American Anthropological Association can vote to censure an individual, but, as has been shown in the past, this action alone doesn't amount to much. Second, the practice of social anthropology doesn't entail highly specialized knowledge or techniques: anyone can do "field work," and the professional jargon is easily mastered.

This last observation is important. Anthropologists, like everyone else, must earn a living. While almost all field work is under government funding, classified research yields greater material benefits. Conservatives, therefore, reason that since the information can be gathered by anyone, they might as well do it themselves and reap those benefits. This train of logic is camouflaged, of course: "[counterinsurgency research] is well within the traditional canons of acceptable behavior for the applied anthropologist, and is [called] counterinsurgent only for present funding purposes; a decade ago it might have been 'mental health' "—quoted from the Report of the Ad Hoc Committee, 1971. In other words, the research hasn't changed, only its label. But a rose by any other name . . . .

The majority of the AAA membership disagreed with the Ad Hoc Committee—they rejected the report. Unfortunately, individuals will probably still choose to work on classified projects. Equally, there is no way to ensure that published data won't be "misused" by anyone so inclined. This situation is what seems to have prompted Dell Hymes to make the statement that "each anthropologist must reinvent anthropology, as a general field, for him or herself, following personal interest and talent where best they lead." This, however, is a cop-out; personal interest too often leads to a Project Camelot.

Reinventing Anthropology, quite rightly, exhorts professionals to come to grips with the real world, to reconsider the basic tenets of anthropology, and to undertake relevant research. But "responsibility" is discussed only on a personal level—there is also a need for profession-wide responsibility. If the AAA will not take it upon itself to pa-

SR RECOMMENDS

SR of The Sciences *recommends the following recently published books in the sciences as being, in the judgment of the editors, particularly worthy of attention.*

ALBERT EINSTEIN: Creator and Rebel. By Banesh Hoffman with the collaboration of Helen Dukas (Viking, $8.95)—An informative and readable account of Einstein's life by a colleague who takes the sensible position that to understand the man, one should understand the works.

FREUD: Living and Dying. By Max Schur (International Universities, $20)—The physician who attended Freud during the last ten years of his agonizing illness searches for the key to the interlocking chambers between the young and the adult Freud and succeeds, in this superb biography, in demystifying and humanizing a rich and complex life.

INSECTS OF THE WORLD. By Walter Linsenmaier (McGraw-Hill, $25)—An entomological survey that is unique in its kind: sumptuously produced (160 full-color paintings and hundreds of drawings), scientifically precise, and written with poetic grace.

LICIT AND ILLICIT DRUGS. By Edward M. Brecher and the editors of *Consumer Reports* (Little, Brown, $15)—From the Consumers' Union, the compleat drug book—everything from cocaine to caffeine—with recommendations for workable drug laws.

THE QUEST FOR MIND: Piaget, Levi-Strauss, and the Structuralist Movement. By Howard Gardner (Knopf, $6.95)—A remarkably lucid, skillful analysis of one of the most influential, albeit controversial and often incomprehensible, approaches to the study of human behavior.

THE SERENGETI LION: A Study of Predator-Prey Relations. By George B. Schaller (Chicago, $12.50)—A major scientific study of the life and behavior of the East African lion and its predator-rivals and prey by a leading zoologist and author of *The Year of the Gorilla* and other books.

THE TIME OF THE BUFFALO. By Tom McHugh (Knopf, $10)—A superb study of the bison in folklore and fact that is also an account of western expansion and a history of the Plains Indians.

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trol its membership, then individuals will have to follow in the footsteps of Eric Wolf, Joseph Jorgenson, and Daniel Ellsberg—they will have to be their brothers' keepers. This kind of social pressure can have an effect even if it serves only as a reminder of the ethical questions involved. Anthropologists have discovered that their work is by nature political; now they have to come to grips with the implications of this discovery. □

SHORTER REVIEWS

Travel

PLACES. By James Morris. Illustrated. 185 pages. Harcourt Brace Jovanovich. $6.95.
James Morris is one of the very few travel writers left who see travel as a romance. His "places" are rococo confections of colors, sounds, and history, and his delight in visiting them so beguiling that he takes the reader with him. This kind of style depends not on brevity but on a Dickensian accumulation of detail, and the 15 travel essays in this collection therefore disappoint in only one way—they all seem too short. Written for a variety of magazines, the essays cover so wide a territory—from Baden-Baden to Fiji to Swaziland—that Morris has arranged them alphabetically, a helter-skelter device that makes this a book to dip into, rather than settle back with, and gives it the feel of a tempting tray of hors d'oeuvres. A good many are concerned with former British colonies, prompting some minor sentimentality about the glory days of the raj, but not one is without interest and what used to be called "atmosphere." Morris is at his best when his subject is romantic to begin with (as in *The World of Venice*, his best book), so his Alexandria, Darjeeling, or Capri seem as fine and complete as carved miniatures, but the unavoidable hell of Calcutta's present makes even Morris's evocation of its imperial past an ambiguous and meager affair. (Chicago, where politics are crucial to the nature of the place, resists the Morris touch in a slightly different way.) Morris is so fine a writer—despite such annoying syntax as "wholesome was the food"—and the quality of his essays so consistent that picking favorites becomes an endless exercise, but the pieces on the Basque country, Ceylon, and Iceland are particularly noteworthy. In a foreword, Morris says the travel essay is a "fading genre" and hints at retirement. One can only hope his wanderlust will prove this an idle threat and start him packing soon—romance is a rare thing in this age of package tours.

THE WINDS OF MARA. By Colin Fletcher. 343 pages. Knopf. $7.95.
Colin Fletcher doesn't much like humankind ("coarse-grained creatures")—an attitude that keeps him fleeing in the opposite direction but also produces marvelous books like *The Man Who Walked Through Time*, about a hike through the Grand Canyon, and *The Thousand-Mile Summer*, about walking the Pacific Crest Trail. When Fletcher discovered the Mara, Kenya's vast animal reserve, he went there to write, to be alone, to watch the animals, and to live in what he anticipated would be Elysium; he left five weeks later, disillusioned, bitter, and bearing a testy book he hadn't intended. The African officials, after refusing him the privilege of a six-month free camping permit (one wonders why Fletcher felt that a "writer's prerogative" entitled him to one), went on to bargain for a payoff, cash in advance, in exchange for allowing him to write about the reserve; photographs would be extra. Fletcher wasn't prepared for that kind of petty corruption, and throughout *The Winds of Mara* he broods, with no particularly original thoughts, on "evil," "good," "bad." But whenever the book gets caught up in the Mara—the endless savanna, the freedom and beauty of the wildlife, the Masai tribesmen—Fletcher is back to writing what he does best, and the book sparks to life. It's truly remarkable, after all, to be able to entice the reader to stay riveted through four full pages about the wonders of the sausage fly.

BAJA CALIFORNIA. By William Weber Johnson. Illustrated. 184 pages. Time-Life. $7.95
Naturalists refer to Baja California—800 miles of virtual wilderness stretching from the United States–Mexican border to below the Tropic of Cancer—as "the forgotten peninsula"; what frustrated developers and explorers as far back as the Spanish conquistadores thought of it seems not to be recorded. In between the heavily populated towns of Tijuana and Mexicali in the north and the thriving territorial capital of La Paz at the southern end, Baja is a dry, surreal, yet startlingly beautiful landscape, which, judging from Jay Maisel's superb color photographs, is inhabited by strange-looking species that have evolved in surprising ways: jackrabbits have no protective coloration but are, instead, glossy black and trimmed with red; bats fish for food; rattlesnakes have no rattles; and 80 of the peninsula's 110 species of cactus are unique. William Weber Johnson, an old Baja hand, writes about it all in an enticing and somehow appropriately wondrous fashion. The most frequent visitors to the peninsula these

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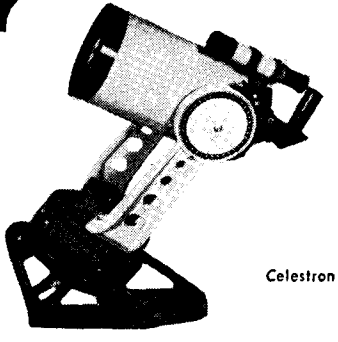

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days are apt to be scientists—Baja is one of the three most cloud-free areas in the world, and a joint United States–Mexican observatory has recently been constructed there—or sportsfishermen, who fly in with bush pilots or their own planes to the few tourist accommodations that are available. The Mexican government is having yet another go at development, but for the time being, at least, naturalists can take a certain satisfaction in knowing that until the highway now being constructed from the north and the south eventually meets in the middle, automobile travel across the rough terrain averages, at most, five miles an hour.

THE POLAR WORLDS. By Richard Perry. Illustrated. 316 pages. Taplinger. $7.95. "The Antarctic . . . comprises a frozen continent surrounded by a partially frozen sea, [and] the Arctic is a partially frozen ocean almost surrounded by land." Neither sounds like a place where you would care to spend two weeks in August, but Richard Perry, in this charmingly written comparative study of the ecology and wildlife of the two polar areas, makes them sound strangely appealing. The Antarctic is essentially the bleak, frozen, wind-howling place that one had always imagined, but Perry shows that it has an austere beauty and, in the sea life and mosses and lichens, even its own abundance. It also has those remarkable creatures the emperor penguins. Perry's description of the male penguin's incubation of the female's egg during nine weeks of the polar night is fascinating, dramatic, and even, as he calls it in quotes, "heroic." Slightly more space is devoted to the Arctic, because there is more to describe. Perry is good on whales and seals and especially interesting on polar bears—solitary, nomadic animals that, except at mating season, avoid each other like relatives who have quarreled. The illustrations are pleasant, the maps informative and well drawn. There is a bibliography for those interested in pursuing the book's subject further and a brief but helpful glossary for those who have forgotten what a "loomery" or a "sauggsat" is. □

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MUSIC

Four Saints, Three Acts, Two Singers

BY IRVING KOLODIN

Of the three works presented by the Metropolitan Opera in its first venture into the intimate area of the Forum in the basement of Lincoln Center's Vivian Beaumont Theater, Virgil Thomson and Gertrude Stein's *Four Saints in Three Acts* came off by far the best. The reason for this is no mystery.

Four Saints has its own inbred style and unreality, which would be self-sufficing in any surrounding, however confined. Needless to say, anyone with a mental image of the marvelously inventive production that Florine Stettheimer conceived for the first viewing of *Four Saints* in 1933 regretted its absence. Why, some may wonder, has no one ever again used the then-new, wonderfully shiny material called "cellophane" for a stage setting? The reason is almost too mundane: the fire department thereafter banned its use for such purposes.

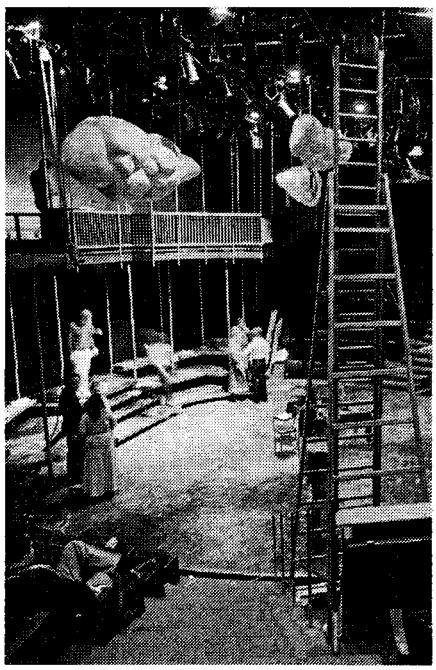
The new settings by Ming Cho Lee and the costumes designed by Jane Greenwood did have their own kind of suitability and spirit, though, especially in the compact surroundings. Together with Shirley Prendergast's lighting, they regenerated the charm and magic in the Stein-Thomson creation beyond what was achieved the last time the work had a Broadway showing (in 1952, with a young singer named Leontyne Price in the ensemble).

For that matter, the aural values are quite sufficient unto themselves, as may be appreciated from the still-circulating disc of the work made in the late Forties under the composer's direction. Thomson's ingenuity and audaciousness in treating Stein's English text as a dead language and applying to her creation of the 1920s all the latitude and liberties Handel permitted himself may no longer be the revelations they once were. They do remain exceptionally consonant with the gentle mood of the play, however, as the music itself rejoices in a unique kind of sonic consonance.

What is even more conspicuous during this performance than in its first viewing is the impulse and momentum *Four Saints* provided for a host of subsequent happenings. These ranged from the Negro talent that went into the later *Porgy and Bess* of the Gershwins to the gifts of the late Alexander Smallens, who conducted both. If one listens with a sense of progression to the Thomson scores for such films as *The River* and *The Plow That Broke the Plains* (in relationship to Aaron Copland's *Billy the Kid* and *Rodeo*), the point of beginning is plainly audible in *Four Saints.*

Any presentation of a Thomson stage work, whether *Four Saints, Mother of Us All*, or the recent *Lord Byron*, is likely to be distinguished by the composer's unerring ear and eye for unfamiliar talent. (Miss Price is but one whose early identification with a Thomson project is well remembered.) This work offers such voices and personalities of future promise as Barbara Hendricks (Saint Settlement), Carolyn Val-Schmidt (Saint Anne), and Connie Barnett (Saint Genevieve). As counterbalance, there was the formidable Betty Allen, whose Thomson-cultured style and sound have come to a full, ripe, plummy beauty in the part of Commère. When Miss Allen was not performing, the younger Carolyn Stanford was an impressively assured, vocally fervent, and pictorially persuasive alternative.

Prominent among the men was Benjamin Matthews as Compère. His name was an inevitable reminder of the fabled Edward Matthews, the original Saint Ignatius (and later Jake in *Porgy*). That role in the present Thomson revival was well taken by Arthur Thompson.



Getting the Forum ready

Alvin Ailey has been widely, and properly, commended for his staging and choreography. He has succeeded in blending an airy, light, and fanciful feeling of his own with the trusting, properly serious, and congenial spirit conceived by such predecessors as John Houseman (direction) and Frederick Ashton (choreography). It is hard to believe that the new blend was not derived, in substantial measure, from Thomson's own participation in the rehearsals. Roland Gagnon conducted with admirable instinct and sense of proportion for an orchestral effort exactly suited to the surroundings.

The coincidence of recitals on the same evening by Marilyn Horne (in Carnegie Hall) and Eleanor Steber (in Alice Tully Hall) was an almost too graphic reminder of the polar possibilities in such events. Taken together, they illustrated, in microcosm, the drama of almost every singer's career. The opening act, by Miss Horne, was a saga of vocal abundance without the interpretative insight that would have rendered it meaningful. The closing act, in which Miss Steber had the starring role, was in the twilight mood of the performer who knows exactly what she wants to do but doesn't have all the resources with which to do it.

Vocalism of the order that Miss Horne offered in "Divinités du Styx" from Gluck's *Alceste* and "Calm Thou My Soul" and "Furibondo spira," both by Handel, is extraordinary and awe inspiring. But her interpretative objectives were all too limited—relating, as in the later "Die Mainacht" and other Brahms songs, to vocal exhibitions rather than emotional expositions. Martin Katz served her well at the piano.

In the portion of the Steber program that I heard, she was working with cunning, insight, and understanding at Schumann's *Frauenliebe und Leben.* Now and then the twilight mood was lit by a warmer glow, a richer recollection of the afternoon of her fame, but noon was a long way off. Perhaps, in the second and third recitals of her series, she will be able to achieve that sense of climax that every good second act should possess. Her pianist was Lambert Orkis, a person of talent not yet qualified to make the effect Schumann wrote into the postlude of his cycle. □

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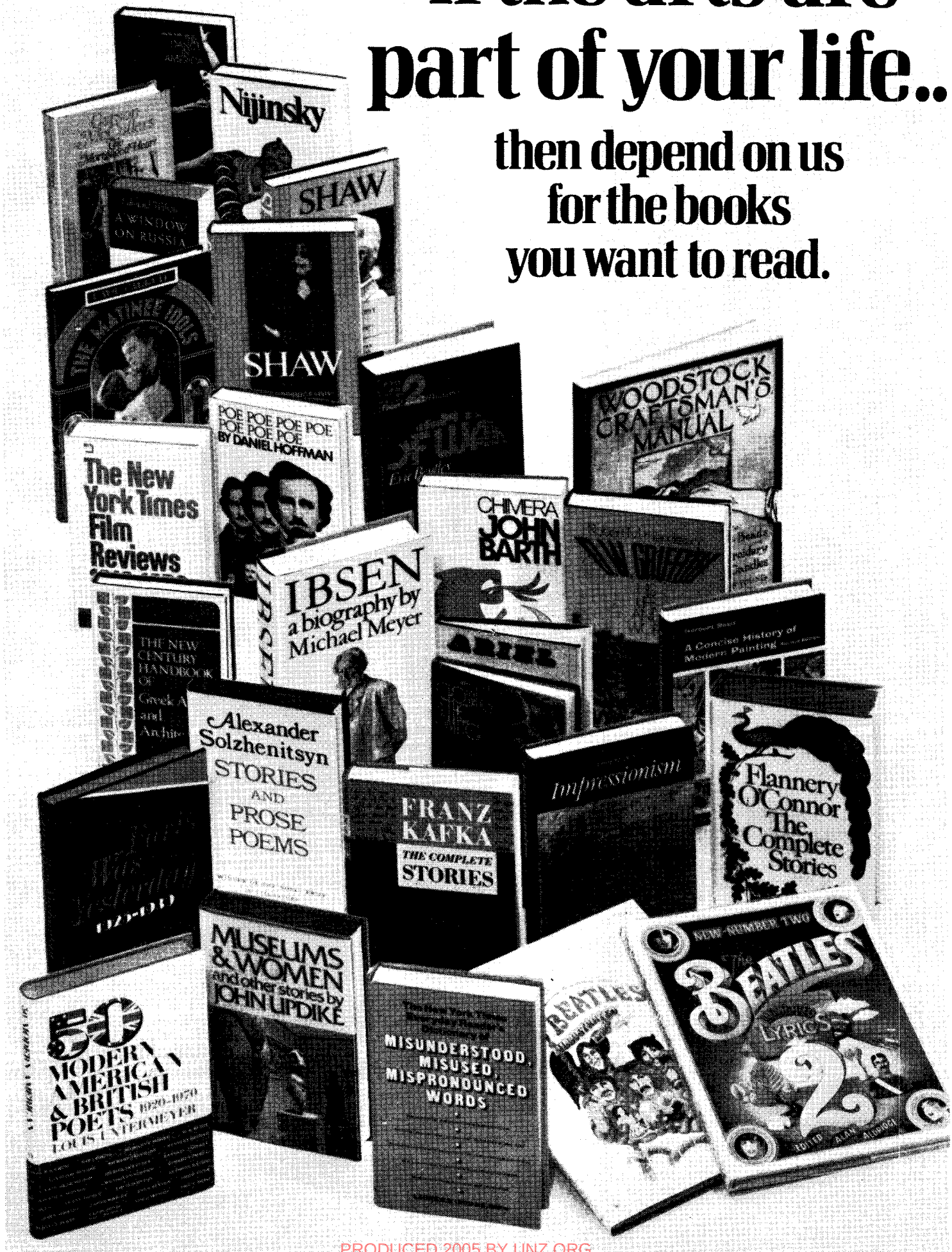
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FILM

Carry Me Back to Shangri-La

BY ARTHUR KNIGHT

One of the surprise hits of the 1937 movie season was Frank Capra's production of *Lost Horizon*—surprising because, after the first preview, the studio had been convinced it was going to be a disaster. But Capra, as he revealed in his recent autobiography, carried the print back to the cutting room, eliminated the first two reels, and the film played beautifully ever after. So beautifully, in fact, that the new lavish Ross Hunter musical adaptation of *Lost Horizon* not only follows the construction of the original, but does so almost line for line, and shot for shot, departing from it only to spruce up two minor characters, to eliminate an awkward and anticlimactic sequence in a London club, and, of course, to make room for the dozen Burt Bacharach–Hal David tunes.

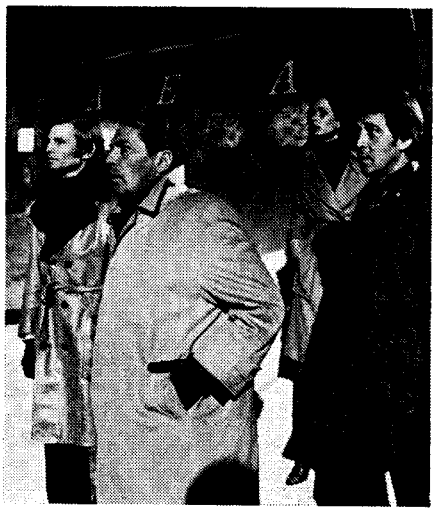
It was a wise decision, even though Hunter might have followed Capra's lead and tried throwing out two reels from the film's final hour, which has a tendency to drag. Two and a half hours, without intermission, is a long time to look at *any* movie; and since many of the musical numbers in *Lost Horizon* are Shangri-La ceremonials that have little to do with either the main characters or the story, they become increasingly intrusive. This is not Bacharach in his popular, "Raindrops Keep Fallin'" vein. Much of the score is introspective, philosophical—not the sort of songs that send you home whistling. This is Bacharach the student of Darius Milhaud rather than Bacharach the hit songwriter. His mood is even more apparent in the extensive underscoring for the film, which includes an impressively intricate contrapuntal interlude that sets a dominant love theme against a gradually diminishing, harshly dissident countertheme.

The difficulty, oddly enough, is in the way the more traditional musical-comedy numbers—for example, Bobby Van's "Question Me an Answer" or Sally Kellerman's "Reflections"—seem to rend the texture of the film, while the Sally Kellerman–Olivia Hussey duet, "The Things I Will Not Miss," sung and danced about the bookshelves and reading tables of the Shangri-La library, seems to come from another movie entirely. This mixture of styles is not in accord with a story that takes itself very seriously and ultimately demands that same seriousness from the viewer.

The original James Hilton novel appeared in 1933, in the very depths of the Depression, and was an immediate best seller. It told of a remote valley, the Valley of the Blue Moon, where all the inhabitants enjoy a life of peace and plenty under the benevolent guidance of their High Lama. To this valley, out of the political turmoil of China in the early Thirties, comes a motley crew of English and American travelers, because one of them, Richard Conway, might possibly be the next High Lama. Richard, a British diplomat, is promptly converted to the Lama's Judaeo-Christian doctrine of kindness, moderation, and love. The others find ways of fitting themselves into the economy. Only Richard's younger brother wants to return to what he persists in calling "civilization."

In 1933—and no doubt in 1937 as well, when the first film version appeared—it was the milk-and-honey aspects of Shangri-La that provided the strongest attraction, although the dangers of benevolent despotism (not to mention white supremacism) were duly noted at that time. Today, I suspect, a land of peace is the greater attraction, a land so remote that it is safe from all invasions, a place where the art, the wisdom, and the technology of our times can be stored up against the day when wars have obliterated all of these from the "civilized" world. Remakes are always tricky, but Ross Hunter, one of Hollywood's most astute producers, could hardly have timed this one better.

Screenwriter Larry Kramer's changes on the original screenplay are equally felicitous. On seeing the original *Lost Horizon* only a few weeks ago, I cringed at the characterization of Richard's younger brother, Isabel Jewel's good-hearted prostitute, and Edward Everett Horton's prissy paleontologist, not to mention a truly embarrassing sequence in which the members of a London club raise their glasses and hope that good old Conway finds his Shangri-La. ("May *all* of us find our Shangri-La," intones one of the company.) In the new version, the brother, played by Michael York, has been toned down considerably. The prostitute is now a suicidal, pill-popping *Newsweek* reporter, and Sally Kellerman, looking marvelous in a dark wig, keeps her intensely and intelligently vibrant and alive. The paleontologist is now a down-at-heels uso performer, energetically and engagingly portrayed by Broadway's Bobby Van.



On the other hand, Peter Finch is hardly an adequate substitute for Ronald Colman in the central role. Finch may or may not do his own singing (there is a rather disconcerting transition from off-screen tenor to lip-sync baritone that creates its own credibility gap), but Colman's insouciant charm, and his very real gifts as an actor, are sadly lacking. The rest is probably simply a matter of taste. I preferred Charles Boyer's High Lama in this one to Sam Jaffe's in the Capra version, but Jane Wyatt's performance in the original to Liv Ullmann's rather smugly liberated lady in this. As to the John Gielgud versus the H. B. Warner portrayal of Chang, the High Lama's major-domo, I'd call it a draw. But who could ever erase the memory of Margo's Maria, that lovely young girl who disintegrated into old age before our very eyes? Certainly not this production's Olivia Hussey.

For a new generation, however, imbued with the ideals of peace and love, this *Lost Horizon* may prove very satisfactory. Its main set, the lamasery, is a distinct improvement over the original, which looked like a model for the Pasadena art museum. Its cast is attractive, if not always distinguished. The music is well crafted, if not memorable. And the production recalls the good old days, when Hollywood sets normally included extensive gardens, five pools, two waterfalls, and a cast of thousands. This *Lost Horizon* is not only a picture that you can bring the kiddies to, it is also—far more difficult to find these days—a movie to which you can take your mother. □

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There Is Also A Small House consisting of 2 bedrooms and a bath, which could be either servants' quarters or a guest house with certain renovations.

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Brown Ledge—Mallett's Bay, Vermont. "One of America's finest camps." Girls 10-18. Free daily riding for all. Finest show horses, mounted lance drill, jumping. Sailing, racing tactics; water skiing, drama, swimming, tennis, golf, archery, riflery, crafts, trips. *No extras!* "The Complete and Different Camp." For booklet, state age and write to winter office: Miss Barbara Brown Winslow, 155 Dodds Court, Box C, Burlington, Vermont 05401.

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L. Work by Robert Owen, *A* ————(4 wds.)

M. Prevention

WORDS

1 126 9 89 42 218 107 68 47 154

10 127 2 48 32 73 170 69 106

76 164 70 85 3 43 123 103 207 137

49 152 138 180 4 52 209 173 77

158 33 131 11 53 101 37 145 211 176 86

38 78 203 6 54 149 12 104 216

179 13 163 55 39 198 128 147

34 136 191 105 226 161 212

125 217 102 190 133 35 157 150 44

200 142 175 182 156 40 206 132

160 45 168 50 74 177 204 7

51 75 174 87 124 153 221 8 215 46 41

222 162 201 186 71

88 192 199 72 130 202 36 155 220

DEFINITIONS

N. Crude but good enough for the purpose (comp.)

O. Baron de ————, Prussian leader in the French Revolution

P. Something that foreshadows a future event

Q. Constant

R. *A hazard of* ———— (King John; Act II, 2 wds.)

S. Derogatory criticism

T. Netherlands village: residence of Wilhelm II of Germany after his abdication

U. Closely combined with something

V. King of England, 925–940

W. U.S. writer and anthropologist, *Patterns of Culture* (2 wds.)

X. Russian novelist and short-story writer, best known work: *Envy* (2 wds.)

WORDS

129 64 25 143 223 169 122 185 117 80 30

56 90

20 58 109 188 31 208

139 183 81 14 61 225 118 100 134

96 184 65 194 144 171 5 165 60

172 66 91 114 15 205 82 57 97 112 148

197 167 146 95 67 196 119 21 181

26 115 214 189 219

210 22 187 178 62 16 120 83 98

59 141 92 27 159 213 17 84 195

151 110 18 99 79 93 63 113 166 224 23

28

108 116 94 135 19 24 193 140 111 29 121

DIRECTIONS

Don't let the definitions scare you. If you can guess five or six of these WORDS correctly, you should be able to solve the Double-Crostic . . . . When you've guessed a WORD, fill in the dashes, and also write each letter in its correspondingly numbered square in the diagram. When all the squares are filled in, you will have a quotation from a published work. Dark squares indicate the ends of words. If there is no dark square at the right side of the diagram, the word carries over to the next line . . . . You should be able to see words and phrases begin to form in the diagram on the basis of having just a few letters. Enter the letters you can guess into the diagram and the blanks in the defined WORDS, and you'll find yourself working from WORDS to diagram and back, solving the puzzle . . . The initial letters of the defined WORDS spell the name of the author and the title of the work from which the quotation was taken. This acrostic feature can be very helpful to the solver.

						1 A	2 B	3 C	4 D		5 Q	6 F		7 K	8 L	9 A		10 B
11 E	12 F		13 G	14 P	15 R	16 U	17 V		18 W	19 X		20 O	21 S	22 U	23 W	24 X	25 N	26 T
27 V		28 W	29 X	30 N	31 O		32 B	33 E	34 H	35 I	36 M		37 E	38 F	39 G		40 J	41 L
42 A	43 C		44 I	45 K	46 L	47 A	48 B	49 D		50 K	51 L		52 D	53 E	54 F		55 G	56 N
57 R	58 O	59 V	60 Q	61 P	62 U	63 W		64 N	65 Q	66 R	67 S		68 A	69 B	70 C		71 L	72 M
73 B		74 K	75 L	76 C	77 D	78 F	79 W	80 N	81 P		82 R	83 U	84 V	85 C		86 E	87 L	88 M
89 A	90 N	91 R	92 V	93 W	94 X	95 S		96 Q	97 R		98 U	99 W	100 P		101 E	102 I	103 C	104 F
105 H	106 B	107 A		108 X	109 O	110 W		111 X	112 R	113 W		114 R	115 T	116 X	117 N		118 P	119 S
120 U	121 X	122 N	123 C	124 L	125 I		126 A	127 B	128 G	129 N	130 M	131 E	132 J	133 I	134 P	135 X	136 H	137 C
	138 D	139 P	140 X	141 V	142 J	143 N	144 Q	145 E	146 S	147 G	148 R		149 F	150 I	151 W	152 D		153 L
154 A	155 M	156 J	157 I	158 E		159 V	160 K	161 H	162 L	163 G		164 C	165 Q	166 W		167 S	168 K	169 N
170 B	171 Q	172 R		173 D	174 L	175 J		176 E	177 K	178 U	179 G	180 D	181 S	182 J		183 P	184 Q	185 N
	186 L	187 U	188 O		189 T	190 I	191 H	192 M	193 X	194 Q	195 V	196 S		197 S	198 G		199 M	200 J
201 L		202 M	203 F	204 K	205 R	206 J	207 C		208 O	209 D	210 U	211 E	212 H	213 V		214 T	215 L	
216 F	217 I	218 A		219 T	220 M	221 L		222 L	223 N	224 W	225 P	226 H						

Solution of this issue's Double-Crostic will be found on page 102.

BRAND-NEW DOUBLE-CROSTICS, NEVER BEFORE PUBLISHED, ARE NOW AVAILABLE IN BOOK FORM, SPIRAL-BOUND, FROM YOUR BOOKSELLER OR SATURDAY REVIEW PRESS, 380 MADISON AVENUE, NEW YORK, N.Y 10017.

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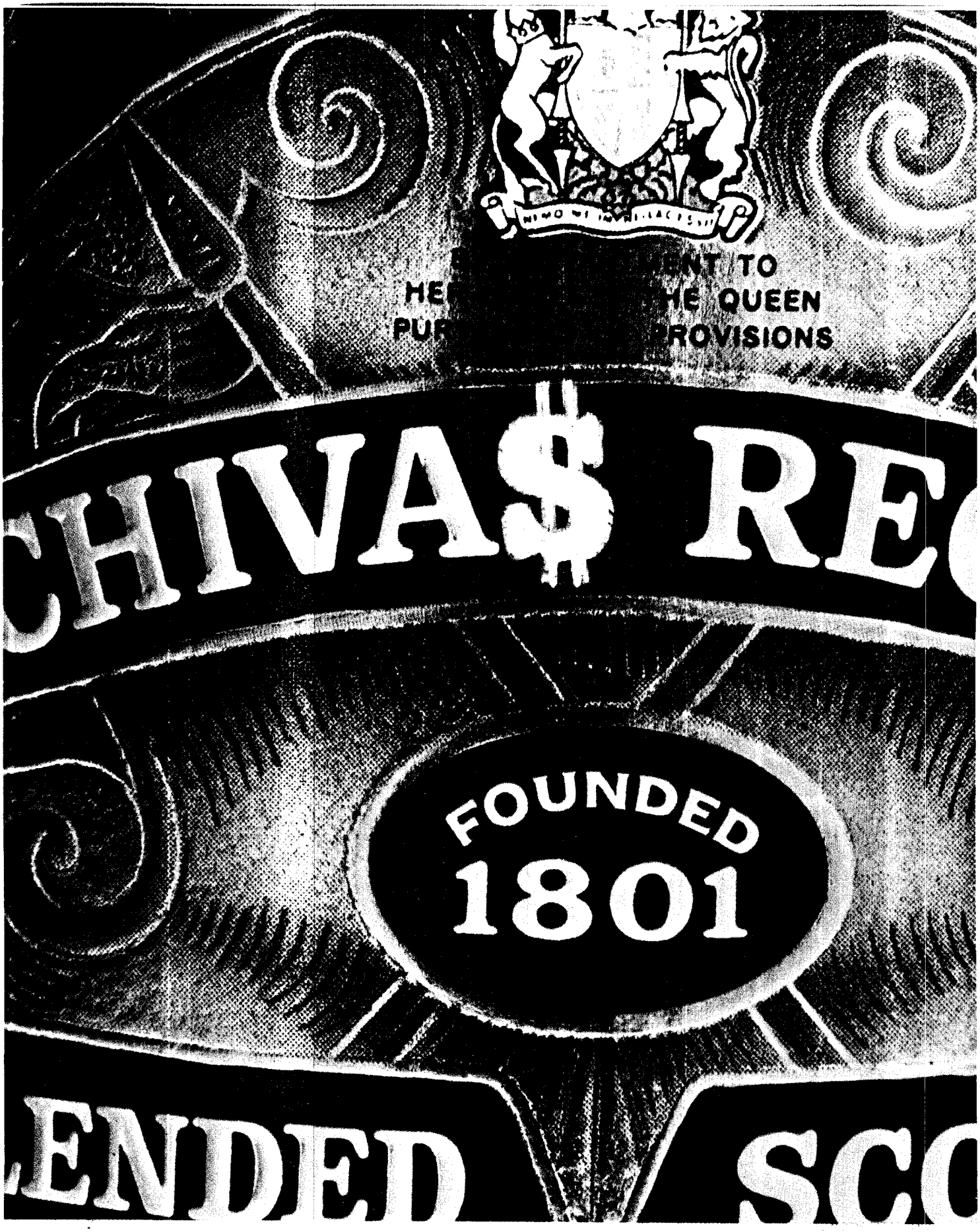

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